DOCUMENT RESUME

ED 221 912 EA 014 760

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TITLE School, Government, and Energy Interactions.
PUB DATE 80
NOTE 70p.; Presented in partial fulfillment of requirements for Political Science degree at Duke University.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Costs; Elementary Secondary Education; *Energy Conservation; *Federal Legislation; Federal Regulation; Federal State Relationship; Fuel Consumption; Policy Formation; *Public Policy; School Buildings; State Action; State Departments of Education; *State Programs; *State Standards; Student Transportation
IDENTIFIERS Energy Conservation and Production Act 1976; Energy Policy; Energy Policy and Conservation Act 1975; National Energy Conservation Policy Act; *North Carolina; *Rules and Regulations

ABSTRACT

This document examines three major federal statutes affecting school energy conservation, describes laws and regulations enacted in North Carolina to promote school energy conservation, and touches on possible energy options open to schools. The federal laws discussed are the Energy Policy and Conservation Act of 1975, dealing with the establishment of plans for energy conservation by the president and requiring enactment of state energy conservation measures; the Energy Conservation and Production Act of 1976, encouraging and facilitating the application of energy conservation and renewable energy measures in new and existing buildings, among other provisions; and the National Energy Conservation Policy Act of 1978, providing funds directly to the states for initiation of energy conservation procedures. The 17 provisions of the North Carolina State Plan for obtaining federal grant moneys for energy conservation measures are detailed next. The remainder of the document consists primarily of a consideration of the feasibility, relevance, and potential impact on schools of energy conservation rules, regulations, and guidelines established by North Carolina. Particular attention is paid to the building code adopted by the state in 1978, the state board of education's regulations regarding transportation and building operation, and the nature of electricity rates applicable to schools. (PGD)

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SCHOOL, GOVERNMENT, and ENERGY INTERACTIONS

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Spring Term 1980

EA 014 760

Interactions between and among governmental entities need to be based on some conceptual idea for desirable results. Unfortunately, there is a strange dearth of conceptual base when energy policy is considered. This dearth does not arise from a lack of data. A plethora of estimates for energy resources, energy uses, and future projections have been made. Much of the time these efforts have been compromised by lack of uniform statistical procedures, varying data bases, and lack of commonality in assumptions.[1]

Energy policy interaction, particularly as it relates to school energy use, is an area where very little study has been done. Many of the same criticisms which apply to energy policy in general apply to educational energy policy in particular. General statements made relative to general energy demand, consumption, and resources need little or no modification to be applicable for educational consideration. Consider the following examples.

> Even though many users have not actually experienced shortages, it is clear that there is widespread concern as to the dependability of fuel supplies, whereas in the past users generally have simply assumed that fuel would be available in the kinds and quantities required.[2]

A few judicious substitutions make this statement highly germane to school administration: change users in the first line to school units, and one has a highly accurate picture of how many school administrators apparently view the energy situation today. However, their influence over the 1974-1976 energy

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[1]Irving White, "Energy Policy Making: Limitations of a Conceptual Model," Bulletin of the Atomic Scientist 27(October 1971):20.

[2]Ibid.,p.22.

legislation enacted by the states indicated either little legislative clout or little interest or both. Energy conservation in education was clearly not a priority, as an examination of state laws relating to educational institutions demonstrates. The Energy Conservation Project Report (ECPR), which was prepared by the Environmental Law Institute, enumerates bills introduced into the various houses in state government. The total number of state bills from 1974-1976 which directly affected education was four. There was one bill in Connecticut in 1975 (PB5254); two bills in Minnesota in 1975 (SF38 and HF1437); and one from New Mexico in 1976 (SM7). There were an additional sixty bills that dealt with schools indirectly by improving energy conservation in state buildings and state cars. Twenty-nine states had no legislation (direct or indirect) reported in the period of the ECPR relative to the educational sector's energy consumption. Perhaps more relevant is that of the sixty-four bills relating to education, only nine became law, and none of the bills directly concerned with education were enacted.[3]

Does the inactivity of legislatures in many states lead to a "... disjointed decision-making (which) often produces socially undesirable and at times socially unacceptable outcomes?"[4] Does, on the other side, this multi-faceted involvement give rise to great diversity which in its encompassing way provides many avenues from which to approach the problem?

Historical observation clearly reveals that our diverse policy-making system is not likely to give way to an all encompassing one way system. The model that was so effective in allowing the United States to put a man on the moon has been suggested for tackling the existing energy crisis.[5]

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[3]Barbara L. Shaw, "ECP State Bibliography," Energy Conservation Project Report 8(December 1976): 22.

[4]White, "Energy Policy Making," p.22.

[5]Ibid., p.26

The purpose of this paper will be to examine the appropriate federal laws, federal regulations, state laws, and state regulations relating to energy conservation and attempt to draw some interactive conclusions. Since energy policy, law, and regulation are tied closely with state-of-the-art technology, a summary section will deal with possible energy options open to schools. Wherever appropriate, in the analysis, specific examples will be given and extrapolated for schools in North Carolina.

FEDERAL LAW

Federal law relating to school energy conservation is embodied in a number of bills but the primary impact comes from three separate bills. The first is the Energy Policy and Conservation Act (P.L.94-163), which was enacted in 1975[6]; the second, enacted in 1976, is the Energy Conservation and Production Act (P.L.94-385)[7]; the third is the National Energy Conservation Policy Act (P.L.95-619), enacted in 1978[8].

These three federal laws form the undergirding for energy conservation in this country. Each act was examined for school relevance and points of governmental interaction. Each of the acts speaks to many broader issues than will be covered in this paper.

The Energy Policy and Conservation Act (EPCA) deals with the establishment of plans to help in energy conservation. Title II of EPCA deals with contingency energy plans as they might be suggested by the President. Several admonitions to the President are contained within the body of this title. In general, any

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[6]U.S., Congress, Senate, Energy Policy and Conservation Act, Public Law 94-163, 94th Congress, 1st sess., 1975, preamble.

[7]U.S., Congress, House, Energy Conservation and Production Act, Public Law 94-385, 94th Congress, 2nd sess., 1976, preamble.

[8]U.S., Congress, House, National Energy Conservation Policy Act, Public Law 95-619, 95th Congress, 2nd sess., 1978, preamble.

presidential plan must be very specific in outlining the need for such action as is called for. Further, the executive must explain the rationale and the operation of the plan. An economic impact evaluation must also be filed "...to the extent practicable..." by the President.[9]

These requirements place an onus on the executive branch of the federal government to come up with plans and to evaluate the plans prior to their implementation. The economic evaluation is a very specific requirement and perhaps portends a broad-view requirement for executive plans. Little or no state action is called for in Title II of EPCA. Some economic input, perhaps, could be required but basically Title II is federal jurisdiction.

Title III of EPCA is greatly different than Title II. Title III has a very high level of required state action. Title III begins with a statement acknowledging a need for states to enact enabling legislation and for regulations to conserve energy. A short statement also lauds the value of such legislation/regulation.[10] After the acknowledgement of need and value of state action, section 362 takes a further step and requires states to establish energy conservation plans. Not only are the plans mandatory, there is also a specific requirement for energy saved. This requirement is for 5% of the projected energy demand for the states in 1980.[11]

A general plan was specified in paragraph a. In subsequent paragraphs, there are some more specific requirements as to the content of the state energy plans. Only those with relevance to education will be considered here. First, mandatory lighting standards are set for all public buildings. Second,

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[9]P.L. 94-163. Title II, Sec. 201, Para. F, Sub.2

[10]Ibid., Title III, Sec. 361, Para. A, Sub. 1.

[11]Ibid., Sec. 362, Para. A.

a promotion of the use of van and car pools and of public transportation is required, but no federal funds are authorized to subsidize the lowering of public transit fares. Third, mandatory standards and policies relating to energy efficiency considerations in materials procurement of states and their subdivisions were established. Fourth, mandatory thermal efficiency standards and insulation requirements for new and renovated buildings were set. Last was a requirement that traffic laws be changed, if necessary, to permit a right turn on red after stopping.[12]

Permission to include other energy saving features in the state plans was given in paragraph d of section 362. States could, if they felt it to be desirable, impose restrictions on the hours of operation of public buildings as well as restrictions on the conditions of operation of these buildings. Second, restrictions were allowable on the use of decorative lighting. Certain transportation controls were also allowed to the states. "Programs of public education to promote energy conservation" could also be included in the overall state energy plan. The final permission was a blanket phrase allowing any other appropriate program or method to conserve and improve energy conservation and efficiency.[13]

While EPCA Title III set up a procedure and outlined a general state energy plan for the states to adopt, a subsequent title (Title V) was very specific in overruling any state law, program, rule, regulation, or order which would be in conflict with P.L.94-163. States could choose to go further if their plans did not conflict with EPCA.[14]

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[12]Ibid., Sec. 362, Para. C, Subs. 1-5.

[13]Ibid., Sec. 362, Para. D, Subs. 1-5.

[14]Ibid., Title V, Part B, Sec. 526.

EPCA's Title IV provides another involvement for schools and administrations. Title IV amends the Emergency Petroleum Allocation Act of 1973 (15 USC 751) to read that fuel (gasoline, #2 diesel, and #6 diesel) allocations shall be made for:

> -protection of public health
> -safety and welfare
> -national defense[15]

Education would fit into these categories in the area of safety and welfare, particularly in welfare.

The Energy Policy and Conservation Act covers many energy topics not listed in the previous discussion; those just discussed seem to be the most relevant to educational considerations. Title III sets requirements for the states and subdivisions to meet in their energy plans. Choice is given for some program elements, but a great deal is rigidly specified.

Reasons for all the specifics in this act (EPCA) are more easily justified if the act is placed in time context. A serious oil embargo had occurred only several years earlier, and the country was just beginning to recover from the economic effects which resulted from the oil shutoff. Government appeared eager to prevent any serious economic consequences should another embargo occur.

The Energy Conservation and Production Act (ECPA) was the second major piece of energy legislation from the 94th Congress. As stated in the preamble to this act, its purposes were:

> To amend the Federal Energy Administration Act of 1974 to extend the duration of authorities under such Act; to provide an incentive for domestic production; to provide for electric utility rate design initiatives; to provide for energy conservation standards for new buildings; to provide for energy conservation assistance for existing buildings and industrial plants; and for other purposes.[16]

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[15]Ibid., Title VI, Part B, Sec. 451, Para. A.

[16]P.L. 94-385, Preamble.

Titles III and IV suggest several things educators need to be aware of in their planning. Title III enumerated several "findings of fact" concerning new buildings. One fact was that large amounts of energy are used each year in the processes of heating, cooling, ventilating, and providing hot water for buildings lacking adequate energy conservation measures. A second finding was that federal performance standards for new buildings can prevent energy waste. The third finding was that failure to provide adequate energy conservation measures in newly constructed buildings increases long-term operating costs and may impinge upon the ability to repay loans made, insured, or guaranteed by federal agencies. In addition, the value of these buildings as collateral is diminished. Another finding concerned using state and local building codes to insure adequate conservation measures without a great deal of direct federal interference.[17]

In addition to the findings of fact, three direct purposes of Title III were enumerated.

> 1-Redirect federal policies and practices to assure that reasonable energy conservation features will be incorporated into new commercial and residential buildings receiving federal financial assistance;
>
> 2-Provide for the development and implementation, as soon as practicable, of performance standards for new residential and commercial buildings which are designed to achieve the maximum practicable improvements in energy efficiency and increases in the use of non-depletable sources of energy; and
>
> 3-Encourage states and local governments to adopt and enforce such standards through their existing building codes and other construction control mechanisms or to apply them through a special approval process.[18]

To prevent misinterpretations the act includes a list of important

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[17]Ibid., Title III, Sec. 302, Para. A.

[18]Ibid., Sec. 302, Para. B.

definitions as they relate to the formulation of law. Several of the more important, and perhaps most open to misdefinition, are listed below. This enumerated list defines the words as they are used in the act.

> 1-The term "building" means any structure to be constructed which includes provision for a heating or cooling system, or both, or for a hot water system.
>
> 2-The term "building code" means a legal instrument which is in effect in a state or unit of general purpose local government, the provisions of which must be adhered to if a building is to be considered to be in conformance with law and suitable for occupancy and use.
>
> 3-The term "commercial building" means any building other than a residential building, including any building developed for industrial or public purposes.
>
> 4-The term "Federal agency" means any department, agency, corporation, or other entity or instrumentality of the executive branch of the Federal Government, including the United States Postal Service, the Federal National Mortgage Association, and the Federal Home Loan Mortgage Corporation.
>
> 5-The term "Federal building" means any building to be constructed by, or for the use of, any federal agency which is not legally subject to state or local building codes or similar requirements.[19]

While Title III was restricted to new buildings, Title IV dealt with older buildings. The general format, while similar, is significantly different and justifies the discussion of the findings of fact relating to old buildings.

Congress found that the fastest and most cost-effective way to reduce American dependence on imported energy would be to encourage and facilitate energy conservation and renewable energy measures for existing buildings. Not only would such a program help reduce energy dependence, it would also be more environmentally sound than continuing with the current trends. Major

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[19]Ibid., Sec. 303.

programs might be needed and should be undertaken to assure that the retrofit and neofit applications occur.

In addition, Congress found that current procedures were deficient due to a lack of available and adequate financing. A shortage of reliable and impartial information concerning savings if particular projects were to be undertaken was another deficiency. A third area of deficiency was the absence of organized programs which could provide information as to easily undertaken projects and their economic value.

If major programs of financial incentives and assistance existed for energy conservation measures, Congress found that there would be a significant drop in the nation's oil imports because of the drop in energy demand. These money programs would also help to ameliorate the impacts of high price energy supplies for those who could not afford the capital investment. A corollary benefit of money programs would be the creation of jobs and a generally healthier economy.

While Congress provided a federal initiative for action, it appeared to recognize the value of local implementation. This is seen in section 402 when as a finding of fact ECPA stated:

> ...the diversity of conditions among the various states and regions of the nation is sufficiently great that a wholly federally administered program would not be as effective as one which is tailored to meet local requirements and to respond to local opportunities...[20]

ECPA was passed to supplement EPCA. It went further in a number of areas than did the original. Provision of more specific advice and more federal dollars made this act important. Both EPCA and ECPA did provide some seed money but were primarily study oriented. The statement at the end of Title IV of ECPA is applicable to both EPCA and ECPA.

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[20]Ibid., Title IV., Sec. 402, Para. A, Sub. 4.

> It is therefore, the purpose of the act to encourage and facilitate the implementation of energy conservation measures and renewable-resource energy measures in dwelling units, nonresidential buildings, and industrial plants, through --
>
> 1-Supplemental state energy conservation plans; and
>
> 2-Federal financial incentives and assistance.[21]

The last of the three primary bills is the National Energy Conservation Policy Act (P.L. 95-619).[22] This bill, in its impact on schools, differs from either EPCA or ECPA by providing the money directly to the states to initiate energy conservation procedures. The act has several titles but Title III deals with schools and hospitals.

The purpose of Title III, according to section 301, is to authorize monetary grants to the States and to public and nonprofit schools and hospitals. The money is to be used in assisting states and their subunits, as well as private, nonprofit schools and hospitals, in identifying and implementing maintenance and operating procedures which will conserve energy. Evaluating, acquiring, and installing energy conservation measures to reduce energy use are also within the purview of Title III. Cost reduction for the schools and hospitals is also a purpose for Title III.

As listed, the purpose has a basis in four findings of fact by the Congress. These findings are:

> (1) the Nation's nonrenewable energy resources are being rapidly depleted;
>
> (2) schools and hospitals are major consumers of energy, and have been especially burdened by rising energy prices and

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[21] Ibid., Sec. 402, Para. B.

[22] U.S., Congress, House, National Energy Conservation and Policy Act, Public Law 95-619, 95th Congress, 2nd Session, 1978, Title I, Sec. 101.

fuel shortages;

(3) substantial energy conservation can be achieved in schools and hospitals through the implementation of energy conservation maintenance and operating procedures and the installation of energy conservation measures; and

(4) public and nonprofit schools and hospitals in many instances need financial assistance in order to make the necessary improvements to achieve energy conservation.[23]

A portion of Title III of the National Energy Conservation Policy Act is an amendment to Title III of the Energy Policy and Conservation Act (P.L. 94-163). The amendment is in the form of an addition and is to form Part G of Title III of P.L. 94-163, and has as its primary purpose the provision of money for energy improvements.

The amendment is very lengthy and enumerates a number of items which can be considered for funding. Any building which includes a heating or cooling system, or both, and was completed on or before 20 April 1977 is covered by the amendment. Energy conservation measures -- meaning installation or modification of an installation in a building -- must have as the primary intent the reduction of energy use or the use of an alternative energy source. These measures, as described in the act, include, but are not limited to -- the insulation of the structure or its systems; the addition of storm doors and windows or other multiglazing or heat reflecting systems; the addition of automatic energy control systems and the subunits needed for these systems to operate steam, hydraulic, or ventilating controls; and the addition of equipment for solar water heating, space heating or cooling, or solar electric generation. The replacement of boilers or modifications designed to make the operation more

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[23]Ibid., Title III, Part I, Sec. 301.

energy efficient is also within the scope of the amendment. Other conservation measures are listed such as weatherstripping, caulking, energy recovery systems, and cogeneration systems.[24]

If a school district can identify ways of conserving energy which are not specifically enumerated in the amendment, these methods can still be considered for funding based on an audit; the specific requirements are described in the act.[25]

Part 2 of Title III elaborates on the idea of federal funding. In this part the purpose is to...

> authorize grants to states and units of local government and public care institutions to assist them in conducting preliminary energy audits and energy audits in identifying and implementing energy conservation maintenance and operating procedures and in evaluating energy conservation measures to reduce the energy use and anticipated energy costs of buildings owned by units of local government and public care institutions.[26]

The purpose, as stated, is based on four ideas. The first idea is that of finite energy resources and their rapid depletion. Second, buildings owned by units of local government are large consumers of energy and are burdened by the ever-increasing cost and potential shortage of fuel. Closely tied to the second idea is the fact that major energy conservation can be achieved in public buildings through implementation of energy conservation maintenance and operating procedures. Energy audits and their high costs form the basis for the last idea. Audits, while potentially very valuable in identifying energy waste, are so expensive that many local governmental units need financial assistance in order to conduct an audit. Evaluating the potential benefits of following

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[24] Ibid., Sec. 302.

[25] Ibid.

[26] Ibid., Part 2, Sec. 310.

through on the audit is also so expensive that it might not be done without financial assistance.[27]

Audits are lauded in Title III as an appropriate method of finding not only where energy waste is occurring, but also finding where savings can be made. The language within the act specifically sets forth criteria which audits must meet in order to be eligible for federal funding. Within the framework of the audit criteria and goals, the Secretary of the Department of Energy will be able to determine "hardship" cases. The basis for hardship cases will be climate, fuel costs, fuel availability, local monetary picture, and other such factors as are deemed important by the Secretary.[28]

Although audits are singled out as being especially useful in most cases, they are generally not eligible for total funding. Section 393 does have a provision allowing the Secretary of the Department of Energy to make grants to the states for the total cost of conducting preliminary audits.[29]

Within the act, specific requirements are enumerated which states must follow when requesting financial aid. State plans shall include the results of audits and estimates of savings if the proposed energy conservation measures are implemented. From the audit should come recommendations as to the types of energy conservation projects. State plans must provide for an equitable distribuiton of dollars among its subunits based on size and relative needs. A guarantee that federal dollars are used as supplemental funds and not replacement funds is required under the guidelines.[30]

Two other general criteria are listed in section 395. One of these is that

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[27]Ibid.

[28]Ibid., Sec. 392.

[29]Ibid., Sec. 393.

[30]Ibid., Sec. 394.

only one application for funding can be made each year. The other is that state boards of education must approve any local project before the federal government will fund the project.[31] An important aspect in funding is that only fifty percent of a project's cost will be borne by the federal grant. If a preliminary audit was totally funded, these dollars must be taken into account when figuring the amount available for the project.[32]

North Carolina has been a consistent leader in anticipating what the federal rules and regulations were going to be. The state hired a consulting group, the Council of Educational Facility Planners, to develop a plan which would meet the requirements of the National Energy Conservation Policy Act. The Council adopted a philosophy that applications for technical assistance would be based on the potential for savings and on fuel type and cost, as well as total consumption.[33]

The Council enumerated eleven legal requirements of the federal act which North Carolina must consider. These eleven are listed below:

1) the agency filing must have legal authority to file;
2) the project must comply with Title VI of the Civil Rights Act (P.L. 88-352);
3) the project must comply with the Uniform Relocation Assistance and Relocation Act (P.L. 91-646);
4) access to the project books must be available;
5) compliance with the Hatch Act;
6) compliance with the Fair Labor Standards Act;
7) compliance with all Environmental Protection Agency regulations;
8) compliance with the Flood Disaster Protection Act (P.L. 93-234);
9) compliance with the National Historic Conservation Acts of 1966 and 1971;

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[31] Ibid., Sec. 395.

[32] Ibid., Sec. 398.

[33] Council of Educational Facility Planners, International, "Proposed North Carolina State Plan for the National Energy Conservation Policy Act of 1978," mimeographed paper, 20 October 1979, pp. 20-21.

10) compliance with all requirements of the federal sponsoring agency; and
11) the prohibition of unfair gain by employees.

Each of the eleven items is contained within "Part V of the Office of Management and Budget (OMB) circular number 038-R0402." In addition to the eleven specific items from OMB 038-R0402, compliance must also occur with OMB circular number A-101 as it relates to application, acceptance, and use of federal funds in a federally assisted program.[34]

The state of North Carolina, through its energy plan, listed seventeen other provisions which must form a part of the grant procedure. These elements are an integral part of the proposal from the Council of Educational Facility Planners, International.

Element one, according to federal rules and regulations, is:

> A statement setting forth the procedures by which the views of eligible institutions or state-wide organizations representing such institutions, or both, were solicited and considered during development of the State Plan. (455.90a)

Pursuant to the first element, the Energy Division of the North Carolina Department of Commerce sought the advice from the identified eligible institutions and their representatives. The input from these individuals and institutions was embodied in the final version of the proposed State Plan which was submitted on 22 October 1979.[35]

Element two is:

> The procedures the State will follow to notify eligible institutions and coordinating agencies of the content of the approved State Plan (455.90b).

This element requires the distribution of a number of copies of the plan to libraries, newspapers, and other locations. In addition, the proviso for work-

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[34]Ibid., pp. 55-59.

[35]Ibid., pp. 1-2.

shops, conferences, and seminars is included to respond to queries on the State Plan.[36]

The third element describes:

> The procedures for submittal of grant applications to the state....(455.90c)

Within this element the dates for submission of grant proposals was set at 20 December 1979, or earlier, if the United States Department of Energy approved the plan prior to 26 December. Included in the requirements for the proposal are Energy Audit Report forms and Technical Assistance Report forms.[37]

Element four lists:

> A description and evaluation of the results of preliminary energy audits which have been conducted in the state....(455.90d)

Preliminary energy audit questionnaires were mailed to a number of institutions and their responses were sampled to give an overall view of their current energy use. Chart number 1 shows the public elementary/secondary schools energy consumption by type and amount.

Number of Institutions (Sample):	50
Number of Institutions (Total) :	2,442
Electricity:	982.01×10^{10} Btu
Coal:	24.50×10^{10} Btu
#5 Oil:	5.99×10^{10} Btu
#2 Oil:	417.46×10^{10} Btu
Natural Gas:	87.36×10^{10} Btu
Water Heating and Cooling:	15.57×10^{10} Btu
Total:	15.32×10^{12} Btu
Btu's Per Gross Square Foot Per Year:	113,000 Btu
Btu's Per Gross Square Foot Per Hour:	75 Btu
Cost Per Gross Square Foot Per Year :	$0.34

Chart 1. Energy Use in Public Schools (K-12)[38]

According to Federal Rules and Regulations, the fifth element included in the North Carolina State Plan consists of:

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[36]Ibid., pp. 3-4.

[37]Ibid., p. 5.

[38]Ibid., pp. 8-9.

> The procedures to be used by the State for evaluating and ranking technical assistance and energy conservation measure grant applications...including the weights assigned to each criterion....(455.90e)

The Energy Division in North Carolina set three procedural steps to insure compliance. These were administrative review, technical review, and final evaluation and ranking. The administrative review deals with the completeness of the application, the technical review with the engineering feasibility of the proposal, and ranking with the relative merit of the proposal based on current goals and objectives. As of the date of the proposal, the rankings were, in descending order:

A. Energy use in Btu per gross square foot per hour
   50 and over
   40-49
   30-39
   20-29
   less than 20
B. Energy cost in dollars per gross square foot per year
   $0.81+
   $0.61 - $0.80
   $0.41 - $0.60
   $0.21 - $0.40
   $0.01 - $0.20
C. Type of fuel
   Oil
   Natural Gas
   Electricity
   Coal
   Other
D. Estimated energy savings in mBtu per gross square foot per year

Other factors, including lighting, building envelope, heating, ventilating, and air conditioning systems, fan energy, and ventilating area are to be included in weighing the various proposals prior to ranking them.[39]

According to Federal Rules and Regulations, the sixth element included in the North Carolina State Plan consists of:

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[39] Ibid., pp. 13-22.

> The procedures that the state will follow to insure that funds will be allocated equitably within the State, including procedures to insure that funds will not be allocated on the basis of size or type of institution but rather on the basis of relative need taking into account such factors as cost, energy consumption, and energy savings, ...(455.90f)

Three groups were established to insure equitable distribution of funds. Two of these groups dealt with technical assistance grants to units of local government, public care institutions, schools, and hospitals. The third grouping was reserved for energy conservation measures from schools and hospitals.[40]

According to Federal Rules and Regulations, the seventh element included in the North Carolina State Plan consists of:

> The procedures that the state will follow for identifying schools and hospitals experiencing severe hardship and for apportioning the funds that are available for schools and hospitals in a class of severe hardship. (455.90g)

Within this element, there are two specific requirements. The first is the establishment of criteria used to identify severe economic hardship; the second is the determination of the level over 50% for which the applicant qualifies.

Federal restrictions governing the hardship funding require certification not be made prior to rankings for the 50/50 matching funds certification. After ranking those institutions which qualify for the matching funds, they may then be considered for hardship cases.

The State Plan interprets the federal regulations governing hardship as follows:

> The Secretary may award 10 percent of the total amount allocated to a state for schools and hospitals for technical assistance and energy conservation measures in a given grant program cycle to cover more than 50 percent, but not to exceed 90 percent, of the cost of a technical assistance program or an energy conservation measure. These additional amounts may be awarded to applicants in a class of severe hardship, ascertained by the state in accordance with the State Plan for buildings...

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[40] Ibid., pp. 36-37.

For elementary and secondary schools, the criteria for severe hardship will be based upon a Wealth Index. Wealth Index will be figured on the following basis:

Wealth Index = (0.78 property value index + 0.22 sales tax index) 0.5 general fund index where:

i. property value index is the ratio of assessed property valuation per student for a given county,

ii. sales tax index is the ratio of collected sales tax per student, and

iii. general fund index is the ratio of county contributions to the state general fund (income tax) per student.

When the Wealth Index is equal to 0.453 or less, the applicant would qualify for 90% of the total funds needed. If the Wealth Index is 3.480 or greater, no hardship funds may be granted.[41]

According to Federal Rules and Regulations, the eighth element included in the North Carolina State Plan consists of:

> A Statement setting forth the extent to which, and by which methods, the State will encourage utilization of solar space heating, cooling, and electric systems, and solar water heating systems. (455.90h)

A desire to encourage solar energy has led the state to apply this element to grant proposals. The State Plan of 1979 calls for proposals using solar energy to be ranked according to their viability. Ranking criteria were set up to insure that solar projects which are funded have a great chance to succeed. Amount of insulation, type of fuel currently used for space heating and water heating, and general building characteristics will each form part of the relative importance ranking scheme.[42]

According to the Federal Rules and Regulations, the ninth element included in the North Carolina State Plan is a statement of:

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[41] Ibid., pp. 42-49.

[42] Ibid., pp. 50-51.

> The procedures to assure that all financial assistance under this part will be expended in compliance with the requirements of the State Plan, in compliance with the requirements of this part, and in coordination with other state and federal energy conservation programs. (455.90i)

The requirements of this section were discussed earlier in the section on the criteria for technical assistance grants. These are contained within Part V of OMB No. 038-R0402 Application Form.[43]

According to Federal Rules and Regulations the tenth element included in the North Carolina State Plan is a statement of:

> The procedures to insure implementation and continued use of energy conservation maintenance and operating procedures in those buildings for which financial assistance is awarded under this part. (455.90j)

Energy conservation maintenance and operating procedures are defined as:

> Modification in the maintenance and operations of a building, and any installation therein, which are designed to reduce the energy use in such building and which require no significant expenditure of funds. (455.2)

To facilitate the compliance with this element, the Energy Division will follow six procedural guidelines. The Energy Division will:

1. Require energy audit reports and technical assistance reports to be submitted with grant applications under this act.
2. Require grant applicants to assure, in writing, that appropriate energy conservation maintenance and operating procedures have been or will be followed.
3. Require experts certify those operational and maintenance procedures to be implemented.
4. Monitor annual energy usage of eligible facilities.
5. Make on-site inspections during construction and upon completion of construction of at least 5% of those institutions receiving funding.

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[43] Ibid., p. 55.

6. Encourage the institutional staff to conduct energy audit updates on an annual basis.[44]

According to Federal Rules and Regulations the eleventh element included in the North Carolina State Plan is a statement of:

> The procedures designed to insure that financial assistance under this part will be used to supplement, and not supplant, state, local, or other funds. (455.90k)

Written assurances are required under the proposed State Plan to insure that grant funds are supplemental and do not supplant other monies. Spot checks are to be conducted among the grantees; random selection of those grantees to be spot checked will insure that all categories of grantees are equally represented in the sample.[45]

According to Federal Rules and Regulations the twelfth element included in the North Carolina State Plan is a statement of:

> The procedure for determining that energy audits performed without the use of federal funds have been performed in substantial compliance with all appropriate federal requirements....(455.90 1)

To assure that energy audits have been performed in compliance with federal rules, the Energy Division has formulated the following three procedures:

1. A specified energy audit format;
2. Identification of the person completing the audit; and
3. Review of the audit reports by a committee representing the Division and the affected institutions (schools, hospitals, public care facilities, etc.)[46]

According to Federal Rules and Regulations the thirteenth element included in the North Carolina State Plan consists of:

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[44]Ibid., pp. 60-61.

[45]Ibid., pp. 63-65.

[46]Ibid., pp. 66-67.

> The procedures for establishment of, and adherence to, milestones for accomplishment of technical assistance programs and energy conservation measures receiving financial assistance under this part. (455.90m)

These procedures are in the form of charts and specific markings for the charts.[47]

According to Federal Rules and Regulations the fourteenth element included in the North Carolina State Plan is a statement of:

> The procedures for determining that technical assistance programs performed without the use of federal funds have been performed in compliance with the federal requirements for the purposes of satisfying the eligibility requirements ....(455.90n)[48]

According to Federal Rules and Regulations the fifteenth element included in the North Carolina State Plan consists of:

> The procedures for State management, financial audit, monitoring and evaluation of technical assistance programs and energy conservation measures receiving financial assistance under this part. (455.90o)

This element of the State Plan addresses the issue of the Energy Division's responsibilities after grants have been awarded by the U. S. Department of Energy to eligible institutions for technical assistance and energy conservation measures. Regulations require four administrative elements as follows:

1. Overall Project Management
2. Financial Auditing
3. Monitoring
4. Evaluation[49]

According to Federal Rules and Regulations the sixteenth element included in the North Carolina State Plan is:

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[47] Ibid., p. 68.

[48] Ibid., p. 74.

[49] Ibid., P. 76.

> A description of the State's program for establishing and insuring compliance with qualifications for technical assistance analysts. (455.90p)

The Energy Division has established that technical assistance analysts in the state of North Carolina will be required to:

1. Have experience in energy conservation and be a registered professional engineer licensed under the regulatory authority of the state of North Carolina; or
2. Be an architect-engineer team, the principal members of which are licensed under the regulatory authority of the State of North Carolina.

The Energy Division conducted a four and a half day training session for prospective technical assistance analysts. In addition, the Division contracted with North Carolina State University to develop training and testing materials for analysts.[50]

According to Federal Rules and Regulations the seventeenth element included in the North Carolina State Plan is a description of:

> The procedures for apportionment of funds among eligible institutions within the State. As a minimum, such policies and procedures shall assure a separate priority ranking... for each building covered by an application approved... for:
> (1) Technical assistance programs for units of local government and public care institutions;
> (2) Technical assistance programs for schools and hospitals; and
> (3) Energy conservation measures, including solar and other renewable resource measures, for schools, and hospitals. (455.90q)[51]

The federal dollars provided through the National Energy Conservation Policy Act (P.L. 95-619) has influenced the State Plan. Whether this influence is good, bad, or benign is not within the scope of this paper. What is of importance is

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[50] Ibid., p. 81.

[51] Ibid., p. 85.

the federal influence on state and local policies. This influence is generated not only by federal legislation, but also occurs in response to rules adopted by the federal bureaucracy.

The supremacy of the federal government in energy matters becomes apparent not only through regulatory agencies and legislative impacts, but also through executive orders. In 1979, President Jimmy Carter ordered temperature restrictions in all public buildings including schools. The restrictions carried with them both civil and criminal penalties for violation.[52]

Rule making does, on occasion, allow for citizen input. In the 7 February 1980 Federal Register, a proposal for a Federal Standby Emergency Energy Conservation Plan was reported. The proposal included a number of proposed energy saving alternatives. Only one, temperature restraint, would directly impact schools. Additional measures were considered, and one of these, school schedule modification, has great potential for impact on schools. The basic concept in this proposal is compression of the five-day week to four days. The lost instructional time could be made up by longer days and use of vacation periods. Vacation periods could also be extended during periods of high energy demand.[53]

At least two individuals have different opinions on whether school schedule alterations, as proposed by the Department of Energy, will have an impact on energy conservation. Shirley Hansen, speaking for the American Association of School Administrators, criticized school closings for energy savings. Among the reasons she cited were:

1. Schools have already reduced energy use by 35% in five years and should be exempt from prescriptive guidelines.

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[52]U.S., President, Executive Order, "Emergency Building Temperature Restrictions," Federal Register 44 (5 July 1979):p. 39355.

[53]U.S., Department of Energy, "Proposed Standby Federal Emergency Energy Conservation Plan," Federal Register 45 (7 February 1980):passim.

2. Schools must be heated somewhat to keep pipes from freezing, and studies have shown that the extra heat needed to make the building comfortable is often marginal.
3. Closing schools on Friday sends students home to raise the thermostats, cook lunch, turn on TVs, or run around in their cars.[54]

Mr. Carsie Denning, former Director of Plant Operations and currently Assistant Controller in the North Carolina Department of Education, conducted a survey in the winter of 1978 which indicated that if schools were closed, more energy would be consumed in the homes. According to Denning, if the purpose is to save energy, school closings are counter-productive. The small research project, conceived by Denning and conducted by students and school personnel, was not totally conclusive. Some of the schools showed energy savings while others showed energy use.[55]

Energy use in schools was discussed by James R. Cox, a consulting engineer. Cox said that part of the problem is due to the overdesign of buildings. Citing the use of air conditioning in elementary schools which operate from 8:00 or 9:00 to 2:00 and with a clientele not caring about a little heat, Cox lends credence to his argument that schools are overdesigned. As further examples, he cites enormous shops and gymnasia for elementary schools.[56]

One way of limiting overdesign of schools has been federally mandated through EPCA and ECPA. Provisions in these acts, as mentioned earlier, requiring the adoption of state standards for energy conservation through building codes, have potential to affect school overdesign.

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[54]"Energy Saving Plan Questioned by AASA," Education USA 22 (24 March 1980): p.231.

[55]Carsie Denning, Personal Communication, 15 March 1980.

[56]Shirley B. Neill, School Energy Crisis, (Sacramento, CA: Education News Service, 1977), p. 23.

North Carolina has adopted a building code based on energy conservation criteria. Those parts of the code which deal with school energy consumption are covered in Chapter XXXII and more specifically sections 3202.1 through 3202.9 within the chapter.

The first section of the 1978 code deals with the groups which are covered by the requirements of the code. In addition to schools (called educational in the code), other covered groups include business, mercantile, institutional, assembly, factory, industrial, and storage. Not only is the type of institution important, but the size is also to be considered in complying with the code. A building of 15,000 square feet or less can meet either prescriptive or performance criteria. Buildings larger than 15,000 square feet must comply with the performance criteria. The specifics of prescriptive criteria (section 3202.8) and performance criteria (section 3202.9) will be listed in the discussion of these sections. If additions are made to existing structures, the entire building need not be brought into compliance, only the new part need comply.

Certain buildings have special requirements and must be designed on the basis of activities or processes carried on or the equipment installed. If exceptions are granted from the design load limitations the building is required to meet the prescriptive requirements of section 3202.8 and the "Thermal Envelope Criteria" form must be submitted.[57]

Definitions are the focus of section 3202.2. Most of the definitions are rather clear but some of these are not as generally understood. The two words most likely to cause misunderstanding are listed with their definitions as they relate to the building code.

1. Coefficient of heat transmission - time rate of heat flow expressed in

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[57]North Carolina Department of Insurance, "Efficient Energy Utilization in New Buildings," North Carolina State Building Code, Volume I-General Construction, (Raleigh, NC: NC Department of Insurance, 11 September 1979), Sections 3202.1, a-d.

Btu/hr/ft^2/^{o}F difference. This is also called the "U-value."

2. Process related energy - energy expended for some other purpose than general occupancy purposes.

Other words defined in this section are building envelope - meaning all parts enclosing the building; glass area; roof area; wall area; floor area; heated and/or cooled space; and exterior decorative lighting.[58]

Section 3202.3 is also definitive. This section delineates the four climatic zones within the state. These zones are important because of their relationships to both the prescriptive and performance criteria. Counties located within each zone are shown in Table 2.

Zone I	Beaufort	Duplin	Pamlico
	Bladen	Hoke	Pender
	Brunswick	Hyde	Robeson
	Carteret	Jones	Sampson
	Craven	Lenoir	Scotland
	Columbus	New Hanover	Tyrell
	Dare	Onslow	Washington
Zone II	Alamance	Franklin	Person
	Alexander	Gaston	Perquimans
	Anson	Gates	Pitt
	Bertie	Granville	Polk
	Burke	Greene	Randolph
	Cabarrus	Halifax	Richmond
	Caldwell	Harnett	Rowan
	Camden	Hertford	Rutherford
	Caswell	Iredell	Stanly
	Catawba	Johnston	Union
	Chatham	Lee	Vance
	Chowan	Lincoln	Wake
	Cleveland	Martin	Warren
	Cumberland	Mecklenburg	Wayne
	Currituck	Montgomery	Wilson
	Davidson	Moore	
	Davie	Nash	
	Durham	Northampton	
	Edgecombe	Orange	
		Pasquotank	
Zone III	Buncombe	Haywood	Stokes
	Cherokee	Henderson	Swain

[58] Ibid., Sec. 3202.2.

Zone III (continued)	Clay	Jackson	Surry
	Forsyth	Macon	Transylvania
	Graham	Madison	Wilkes
	Guilford	McDowell	Yadkin
		Rockingham	
Zone IV	Alleghany	Mitchell	
	Ashe	Watauga	
	Avery	Yancey[59]	

Table 2. Building code 3202.3 Thermal Zones

Infiltration and ventilation are the topics of section 3202.4. Infiltration limits mentioned in this section can be minimized, as noted within the section, by caulking, weatherstripping, applying gaskets, and otherwise sealing the building envelope. This section sets the maximum ventilation air quantity at 33-1/3 percent of the minimum value for each occupancy type.[60]

The next section deals with heating, ventilating, and air conditioning. Within this section, systems of space conditioning requiring the simultaneous administration of heating and cooling are recognized as inefficient and are discouraged. These systems can be used in new buildings only within restricted limits. Sizing of equipment is also specified in this section. Temperature limits are set so that between 68°F and 78°F, no heating or cooling is required.[61]

Lighting and service water heating are covered in the next two sections. Specific requirements provide for energy conservation within the two sections. For example, the maximum allowable lighting load may not exceed 3.0 watts per gross square foot.[62]

Hot water tanks are limited to a load of 4 watts per square foot of tank surface area. The amount of water in showers is limited to 3 gallons per minute

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[59]Ibid., Sec. 3202.3.

[60]Ibid., Sec. 3202.4.

[61]Ibid., Sec. 3202.5.

[62]Ibid., Sec. 3202.6.

per showerhead. Lavatories are limited in both the amount of water (0.5 gallons per minute) and in temperature of the water (110°F.).[63]

Section 3202.8 dealing with prescriptive criteria and section 3202.9 dealing with performance criteria are the most important sections in Chapter XXXII of the building code. The most germain parts of each of these sections are listed in Tables 3 and 4.

(a) Building Envelope Requirements

For calculations required under this Section to verify Code compliance, the following criteria shall apply:

(1) Outdoor design temperatures shall be in accordance with Table A.

TABLE A-OUTDOOR DESIGN TEMPERATURES

ZONE (See Table I)	(Winter) DB	(Summer) DB	WB
I	20°F	92°F	81°F
II	15°F	94°F	78°F
III	10°F	90°F	76°F
IV	0°F	86°F	74°F

(2) The building envelope gross heat loss shall be calculated in accordance with Chapter 21 of the ASHRAE Handbook of Fundamentals, 1972 Edition.

(3) The building envelope gross heat gain shall be calculated in accordance with Chapter 22 of the ASHRAE Handbook of Fundamentals, 1972 Edition.

(b) Building Energy Requirements

(1) The energy-consuming load shall consist of the sum of the peak (maximum normal) steady-state simultaneous loads imposed by the energy consuming items in the building...Heating requirements shall include any reheat required over and above building shell loss and ventilation heat load.

(2) Maximum allowable allotment for on-site fuel-fired equipment shall be selected on the basis of the output rating of the equipment.

Table 3. Performance Criteria.[64]

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[63] Ibid., Sec. 3202.7.

[64] Ibid., Sec. 3202.8-3202.9.

(a) General

The stated U value of any one assembly, such as roof/ceiling, wall or floor may be increased and the U value for other components decreased, provided that the overall heat loss from the entire building envelope does not exceed the total resulting from the conformance to the stated U values.

(b) Wall Thermal Performance

The gross area of exterior walls shall have a combined thermal transmittance value (u) not exceeding the values listed in Table A. Under no conditions shall the opaque wall have a "U" value greater than 0.280.

(c) Roof Thermal Performance

The gross area of building roof shall have a thermal transmittance value of not exceeding the values listed in Table B. Where return air ceiling plenums are utilized, the thermal transmittance of the ceiling shall not be considered.

TABLE A-WALL THERMAL PERFORMANCE

WALL WEIGHT (LB/SF)	U					
	3 Stories and Under			Over 3 Stories		
	Zones I & II	Zone III	Zone IV	Zones I & II	Zone III	Zone IV
0-15	0.335	0.298	0.294	0.399	0.370	0.354
16-40	0.342	0.302	0.296	0.411	0.378	0.359
41-80	0.350	0.306	0.300	0.424	0.386	0.366
81-120	0.358	0.310	0.304	0.436	0.393	0.372
121+	0.361	0.312	0.305	0.441	0.397	0.375

TABLE B-ROOF THERMAL PERFORMANCE

ROOF WGT. (LB/SF)	ZONES I AND II	ZONE III	ZONE IV
0-10	0.098	0.089	0.084
11-50	0.105	0.094	0.087
51+	0.113	0.099	0.092

(d) Floors Over Unheated Spaces

The floor of a conditioned space located over an unconditioned space or outdoors, shall have a thermal transmittance value not exceeding 0.14 in Zone I and II, 0.11 in Zone III, or 0.08 in Zone IV.

(e) Slab-On-Grade-Floors

Slab-on-grade-floors shall be insulated around the perimeter of the floor with rigid-type insulation having a minimum "R" value of 3.75 and specifically designed and recommended by the manufacturer for this service. The insulation shall extend downward from the top of the slab for a minimum distance of 24 inches or downward to the bottom of the slab then horizontally beneath the slab for a minimum total distance of 24 inches.

Table 4. Prescriptive Criteria

Regulations promulgated in a state building code are valuable when new construction is planned. When no new construction is in the offing, then operational rules must be issued if energy is to be saved.

In North Carolina the State Board of Education has taken the lead in adopting a number of energy conserving regulations relating to school operations, including transportation.

While energy conservation is an admirable goal, cost reduction is an equally strong incentive for conservation. Based on data supplied by Carsie Denning of the Controller's Office in the North Carolina Department of Public Education, buses in North Carolina average four miles per gallon. Figures compiled on 5 March 1980 indicated a use rate of 101,000 gallons per day at a cost to the schools of $0.95 per gallon. This compared with data from 1979 indicating a use rate of 100,000 gallons per day at a cost of $0.454 per gallon.[65]

Costs for gasoline from 1979 to March, 1980 were up more than 100%, while usage was up only 1%. The rise in school cost for gasoline portends economic problems for the school board responsible for transportation costs. Some of the options available to the board include decreasing the number of miles traveled, improving the efficiency of pick-ups, and increasing the efficiency of the buses. Each of these options will need study if gasoline costs continue to escalate.

Some operational procedures may help to alleviate the problem. In a basic policy statement distributed to North Carolina superintendents, State Board of Education regulations gave emphasis to what can be done from an operational standpoint.

Thirteen regulations from the State Board of Education regarding transportation were presented in the policy statement. These thirteen are basically operational regulations. First, according to the State Board, priority must

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[65]Carsie Denning, Personal Communication, 15 March 1980.

be given to gasoline conservation in determining school reorganizations, schedules, and pupil assignment. Second, dual transportation should be planned to provide maximum gasoline efficiency. Third, plan bus routes so that buses are fully utilized eliminating overlapping routes, backtracking mileage, and unnecessary trips. Next, care should be exercised so that stops are no closer than 0.2 mile unless safety dictates otherwise. Fifth, buses should not wait at a stop longer than the time specified by the local board of education. Sixth, drivers should be instructed to restrict warm-up time to the time necessary for the engine to reach a safe operating temperature. The interior temperature of the bus is not to be a part of the warm-up criterion. Seventh, during the loading and unloading of pupils at school, the engine should be turned off. Next, any driver transfers that are necessary (regular driver to substitute or vice-versa) should occur at school and not at homes except in emergencies. Ninth, more gasoline than needed for the bus to complete its schedules should not be put in the tank. Tenth, schedules for service trucks and gasoline trucks should be planned so as to minimize mileage. Eleventh, service trucks should be used only for servicing school vehicles. Twelfth, service trucks should be monitored during summer months to insure their use only as authorized. Lastly, buses should be maintained in order to assure peak operating efficiency.[66]

Adhering to the operational regulations, set forth by the State Board of Education, will limit the number of additional dollars needed to keep up with rising costs. Conservation does not, however, prevent the ultimate consulsion, whatever it may be. All conservation does is to slow the rate at which the end is reached. In other words, conservation buys time but does not affect the outcome.

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[66]"Transportation," Local Energy Program Manual for Superintendents, (Raleigh, NC: NC Department of Public Instruction, December, 1979), pp. 65-67.

With three-quarters of a million pupils transported every day, any slow down is welcome. Anything which will limit the 20,000 daily trips of the 12,000 buses will lower economic costs and lead to energy conservation.[67]

In addition to the transportation issues, the State Board also set additional regulations governing school operations relative to energy use. There were ten regulations adopted by the board which, if followed, would limit the total energy used in the schools.

> COMFORT TEMPERATURE SETTINGS - (Grades 7-12 and Institutions of the Community College System) - Space temperature settings will insure that no energy consuming assistance will be provided to obtain a temperature of more than 65°F. during the heating season and less than 78°F. during the cooling season.
>
> (Grades K-6) - Space temperature settings will be determined by appropriate LEA personnel so as to provide the minimum acceptable temperature during the heating season and for the maximum acceptable temperature during the cooling season. Such things as degree of activity, type of floor, age of occupants, unusual health situations and other factors should be considered in determining acceptable temperature settings.
>
> DOMESTIC HOT WATER TEMPERATURE SETTINGS - Domestic hot water being used for anything other than dishwashing will not be provided at temperatures greater than 105°F. Hot water being used for dishwashing purposes will be heated so as to provide the most efficient use of energy in obtaining the necessary temperature. Consideration will be given to the heating of water that may provide water in excess of 140°F. before entry into the dishwasher booster depending upon the electrical power rate schedule.
>
> UNOCCUPIED PERIOD TEMPERATURE SET-BACK - Methods will be provided to assure that no energy consumption will be maintained except for necessary building protection during all unoccupied hours. Program clocks or more sophisticated controls will be employed for this purpose. These settings will be for no more than 50°F. during the heating season.
>
> ENERGY SOURCES - The use of natural gas, wood, and coal will be used where possible for comfort and water heating for conversions, replacements, or additions.

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[67] Ibid., p. 65.

COMMUNITY USE OF FACILITIES - Administrative units will establish policies relating to energy use for community use of school facilities. Consideration for these policies will take into account maximum use of residual heat from day occupancy without supplemental heating or cooling for night occupancy.

GYMNASIUM USE - Neither heating nor cooling will be maintained in gymnasiums for non-school hours unless scheduled activities are taking place in which teams or large portions of teams are involved.

COMPUTERIZED MONITORING AND REPORTING PROGRAM - Each administrative unit and each institution of the Community College System will participate in the state-wide computerized energy monitoring and reporting program being conducted by the Division of Plant Operation of the Controller's Office.

ADMINISTRATIVE UNIT ENERGY MANAGEMENT PROGRAMS - Each administrative unit and each institution of the Community College System will prepare in writing an energy management program that will include all sectors of operation. Copies of these written programs will be available to the State Board of Education upon its request.

ELECTRICAL LOAD MANAGEMENT - Administrative units and institutions of the Community College System having all-electric facilities will make a thorough study of the existing electric power rate schedule for each facility and prepare a written electrical load management program for each facility that will include operation of cafeteria, athletic facilities, auditoriums, and classroom areas.

COMPLIANCE - The Division of Plant Operation shall develop detailed instructions to insure compliance with these rules and regulations.[68]

In addition to all the requirements set forth by the State Board, there are a number of conservation suggestions which originated within the Division of Plant Operations. These suggestions were issued in December, 1978 and were revised in March, 1979. The list of recommendations is listed in Appendix A.

Not all regulation affecting schools comes from the board of education. Some regulatory agencies greatly impact energy cost and use. In North Carolina,

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[68]"N.C. School Plant Conservation Policy," (Raleigh, NC: NC Board of Education, 2 August 1979), passim.

the Public Utilities Commission in setting electric and natural gas rates impacts school costs and causes schools to be eligible or ineligible for certain rates.

Electric rates for schools will be covered as an example of the type of regulation promulgated by the Utilities Commission. Duke Power Company, the largest electrical supplier in the state, will be used as the prime example for school rates.

Duke has a number of rate schedules, but which ones are available to particular schools depends on load characteristics. Some rates, residential, industrial, and resale, are not available to schools. Within the classification system used by Duke Power, all school rates would be classified as General Service. General Service schedules are subdivided depending on equipment, for example general service, water heating; general service, all electric; general service, all electric/solar (experimental); general service, miscellaneous.[69]

Rate structures are hard to understand and when the concepts of contract demand and demand billing are added, many school people simply are overwhelmed. By far, the best way is to contact the appropriate energy company and request an explanation. At times a very specific understanding is not required and only a superficial grasp of the concepts involved is sufficient. In the following section, one particular general service rate schedule - general service, all-electric - will be examined. The general understanding of this schedule should make it easier for the school administrator to comprehend the particular schedule for his/her jurisdiction. Since rate schedules vary from company to company, from time to time, and from state to state, the schedule which is being explained is that applicable for Duke Power's North Carolina customers as of 1 April 1980.

Examination of the rate schedule for general service, all-electric -

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[69]Duke Power Company, Rate Schedules, (Charlotte, NC: Duke Power Company, 1 April 1980), passim.

designated GA (NC) - reveals several sections. These sections are availability, types of service, rate, approved fuel charge, determination of billing demand, minimum bill, power factor correction, payment, contract period, and interruptible power provisions.[70]

To fully understand the make-up of the school or school systems' electric charges, it is necessary to understand each of these sections. As was alluded to earlier, a school administrator has a difficult time understanding all these factors. If the school system is large enough, a specialist can be hired to provide the constant monitoring needed to reduce not only energy consumption but energy costs. Occasionally a State Board of Education will appoint persons on the state level to be responsible for reducing consumption and costs. North Carolina has created state level staff positions to carry out this energy consciousness.

A copy of the Duke rate schedule GA (NC) is found in Appendix B.

Explanations of the sections on availability, type of service, and rate are sufficient within the schedule GA (NC) itself. The approved fuel charge for general service customers is figured on the same basis as for residential customers. Namely, if cost for fuel rises or falls from the amount allowed in the base rates, then a fuel charge adjustment will be made.

Schools, as well as other general service customers, are billed for electric energy that Duke Power supplies to them. In addition to the cost for the total amount of electricity, large users are also charged for demand. Demand charges accrue due to the fact that the electric company must size its generators, substations, transformers, transmission lines, and meters based upon the volume of electricity required. For example, if an individual were to require one kilowatt-hour of electricity for twenty-four hours, the total electricity used would be twenty-four kilowatt-hours (24 kwh). If, on the other hand, a consumer were to use

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[70]Ibid., N.C. 28th Revised Leaf no. 22, pp. 1-4.

twenty-four kilowatts of electricity for one hour the total use would likewise be 24 kwh. From the company's standpoint, the two usages described create entirely different problems. Total amount of use is identical; it is the rate of use which varies. An attempt by the Utilities Commission to achieve equity among ratepayers dictates Duke Power's policy of a demand charge based on rate of demand. This demand affects rates; it is also important in determining the minimum bill.

Demand, sometimes called billing demand, may be considered important only for a particular month. This assumption is not entirely accurate, as an examination of the wording from the appropriate section of the rate schedule will illustrate.

> The demand for billing purposes each month shall be the maximum integrated thirty-minute demand measured during the month for which the bill is rendered, but not less than 50 percent of the maximum monthly demand during the previous 12 months, including the month for which bill is rendered, nor less than 50 percent of the contract demand, nor less than 15 kw; however, the minimum billing demand for contracts made prior to March 15, 1971 shall be 5 kw until the maximum integrated thirty-minute demand measured during the month for which the bill is rendered becomes 15 kw or more, after which time the minimum billing demand on such contracts shall be 15 kw.[71]

When the statement on billing demand is analyzed, it becomes clear that not only does a high demand affect the rate in a particular month, but that this demand is carried for twelve months. This process is referred to as the twelve month ratchet.

Also from the demand statement, it becomes very important that the contract specify the proper demand. Even if a contract demand is set too high, at least 50% of that demand will be charged regardless of use. Large school systems having consultants and those using the state education agency consultants should have no trouble in accurately sizing demand. Systems which have novice contractors and

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[71] Ibid., p. 2.

who fail to utilize advice from the state agency and the utility company may be penalized by higher electric bills than are necessary.

Within the rate schedule GA (NC), a provision for interruptible power exists. The basic concept of this provision is that if the customer allows Duke Power to, in effect, turn off some of the demand, then the customer will get a price reduction. Most schools are probably not in a position to avail themselves of this part of the rate schedule.[72]

An administrator dealing with electric terms may often be assailed by the jargon. One of the best compilations of jargon and "English" definitions is one that was prepared by E. A. LeBlanc of the Council of Educational Facility Planners, International. His glossary is found as Appendix C.

FUTURE OPTIONS

If the morass of governmental regulations, laws, rate structures, and procedures are incomprehensible, the future options for the school administrator are equally obtuse. Anything written on the future as it relates to energy stands a very good chance of being obsolete almost before the ink is dry.

An attempt to discuss the long-term future would, upon examination, be found to be the present in one school system or another. Some systems are more attuned to change and make those futuristic steps before the majority of the other systems.

Occasionally a national organization will enumerate items to be studied for possible help in the reduction of energy consumption. One such organization is the American Association of School Administrators (AASA). The AASA devised a list of eight items which could be used to lower a district's transportation costs. These items, unlike those suggested by the North Carolina Board of Education, deal with modifications or replacements of equipment and not its operation.

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[72] Ibid., pp. 3-4.

1. Diesel fuel is a better buy than gasoline.
2. Automatic transmissions increase mileage by 5-7%.
3. Radial tires increase mileage figures.
4. Solid state ignition improves performance.
5. Rubber suspension systems increase mileage by 5-7%.
6. Fuel injection delivers more miles per gallon and better operation.
7. Lower rear end ratios allow better mileage.
8. Buses properly sized for the job eliminate waste.[73]

New developments in the energy field, as noted earlier, are happening at a very rapid pace. These developments include, not only new inventions and discoveries, but also new ways of looking at old problems. Some of the new ideas can be utilized by schools, others will have limited application at best. This rapid expansion of energy knowledge makes it imperative that the administrator is, at the very least, cognizant of what is occurring in this field. The lack of knowledge, as far as energy is concerned, results in a cost that school systems should not have to bear.

Courses in energy basics should be required of all prospective school administrators. For those superintendents and principals already on the job, a series of workshops to fill the knowledge gap should be a primary goal of state boards of education and schools and departments of education in the universities.

Failure to take full advantage of energy saving technology hurts everyone, but may ultimately precipitate a crisis, as far as the educational system is concerned.

School administrators should be in the forefront of calling for this action. Administrators should be demanding, both privately and professionally, more bills like 95-619 and not retreating in ignorance whenever energy topics are broached or if retreat is not possible to wring their hands, shake their heads, and say that we have to do something about our energy use. The time for personal action from administrators is now. Role models do exist. Costs of energy will increase; what suffers - program, salaries, opportunities - is up to the administrator.

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[73]Neill, School Energy Crisis, p. 71.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING OPERATION - HEATING

1. In order to meet one of the requirements for "Matching Funds" expected to be available in the near future for building renovation to reduce energy consumption, we recommend that a written operating procedure be developed and posted at each school. This should state the operations of HVAC system and should reflect the "individual differenc of that particular system. This should be developed jointly by the Maintenance Director, Principal and Custodian.

2. We recommend that an operating policy be adopted which states: During operating hours, maintain occupied spaces at approximately 68° on heating cycle, except for 65° in cafeteria, corridors and shops, 62° in gyms. Maintain approximately 80° on cooling cycle. Maintain relative humidity in a range of 20% to 60%. Maintain a controlled flow of fresh outside air to all occupied spaces according to the minimums and maximums now specified in the N. C. Building Code.

3. Encourage wearing of appropriate clothing during heating season. Sweaters conserve body heat, allowing for escape of normal moisture. Add or remove coats and sweaters during day as needed.

4. Buildings should be completely closed when school terminates. Non-operating time heat losses are a major part of the total. Heat energy stored in mass of building floor, walls, roof, etc. should be conserved.

5. Outside doors should be kept closed (check automatic door closers). Report poorly fitting doors promptly. Exfiltration (dumping of heated air) is a major loss.

6. Assign students to see that doors and windows are kept closed, except when open for ventilation. Cooperation of all persons is very important in conserving energy.

7. During heating season, close blinds, draperies, shutters and other window covers at the end of each day's operation. Insulated window closures can reduce heat loss through windows during non-operating hours.

8. Consider reducing heating of greenhouses in winter (heating costs are very high). Consider alternative fuels other than electrical.

9. Portable electric heaters should not be used in classrooms to supplement existing heat.

10. Reduce and/or turn off selected heating units in corridors, storage and unoccupied zones such as auditorium and gymnasium, consistent with weather conditions.

BUILDING OPERATION - HEATING (Continued)

11. During heating months, take full advantage of outside temperature increases and morning solar heat gain by manually switching off the heating system at an appropriate time after initial morning warm up. Anticipate the weather - (temperature, wind, sunshine) several hours ahead.

BUILDING OPERATION - COOLING (AIR-CONDITIONING)

1. On schools with air conditioning, where equipment has economizer cycle, use outside air for interior cooling whenever possible. Maintain the outside air damper controls carefully.

2. On air conditioned buildings, special attention should be paid to window areas. Curtains or blinds can reduce solar heat gain through windows. Outside shading of all glass during cooling season is very important in reducing electrical use. Shade from deciduous trees is very effective.

3. Principals should check periodically during cooling cycle to determine if air conditioning window units or central units have been left on.

4. In buildings with or without mechanical cooling, natural ventilation cooling through windows may be utilized for the many mild days (65^{o} to 85^{o}) during spring and fall. See notes under windows and doors on shading, sun and wind orientation. In hot weather, opening windows early in the morning before 8:00 a.m. will help to release stored heat.

BUILDING OPERATION - CONTROLS

Controls should be set and maintained carefully by the Maintenance Staff. Improvement to controls generally have a short pay-back of investment.

1. Cafeterias, gyms, shops, and other spaces may become overheated due to body heat, more physical activity and solar gain through windows. Set thermostats lower or use manual control as appropriate.

2. Check early morning warm-up time, and on non-electric heat buildings, set seven-day clocks to come on as late as possible consistent with individual building conditions. Monday morning settings may need to allow for longer warm-up time.

3. Completely close one or more radiator valves in overheated rooms as a seasonal solution to uneven distribution. Report problem to Maintenance Department.

4. Use over-ride timers, (if available) or other methods to control heat to selected areas for after-school use, avoiding the heating of unused areas.

5. During mild weather, (50^{o} to 65^{o}), many times only the chill needs to be taken off the building. Clocks which control the heating system may be set for a limited schedule. Example: clock set to start at 7:00 a.m. and cut off at 9:00 a.m. Manual control is also very helpfu

6. Cut off boiler when outside temperature reaches approximately 60^{o} F. Anticipate the effects of weather changes on heating, cooling and ventilating demands.

7. Principals and Custodians should understand their building systems, controls, and individual conditions. Post operating procedures.

8. During heating cycle, regulate each room temperature by closing radiator valves or other appropriate controls. Windows should be opened just enough for fresh air where there is no other air supply system. (Fans, ducts, outside grills.) If all other methods are ineffective, open room door and windows to exhaust excessive heat.

9. Check periodically for proper operation and tight fitting condition of all outside air dampers. Most older types leak excessively even when closed. Consider replacing older types with new type which has interlocking blade edges and compression seal.

BUILDING OPERATION - LIGHTING

1. All lights should be switched off in all unoccupied spaces. Five minutes off time is the break-even point on total cost.

2. Encourage use of natural light when possible, consistent with proper light levels. Adjustment of shades or blinds during different hours of the day and for each day's sun conditions is desirable. Success of these adjustments is largely dependent upon each room's sun orientation and the roof overhang shading protection. Blinds should be left free of use as displays which block out light.

3. In most classrooms, the lighting should be divided into two or more rows or circuits. Where natural lighting is of good quality, one row near the windows may be switched off on sunny days. This will help maintain proper light levels.

4. Check typical classroom light levels with a (foot candle) light meter. Inform school personnel of lighting levels. Recommended maximum light levels are 70 fc for classrooms, 20 fc for corridors, 70 fc for libraries, 30 fc for toilets. Many classrooms are operating on 50 fc, according to teachers interviewed, with quality lighting.

5. In air conditioned buildings, lighting should be reduced to the minimum required in that it adds heat to the air conditioning load.

6. Operate lighting in dining spaces only when in use and only if natural light is not adequate. Kitchen staff should be responsible for this operation. Twenty foot candles is recommended for dining spaces. Cafeterias are commonly overlighted. Check with a light meter.

7. As a temporary solution, replace high watt bulbs with lower wattage bulbs, in spaces such as cafeterias, conference rooms, closets, corridors and toilets where lower light levels are adequate. Use 60, 75 or 100 watt bulbs in place of 150,200 and 300 watts.

8. Use supplementary lamps where provided at fixed location tasks such as: teachers desks, carrels, drafting tables, shop tools, book shelves, displays, etc. Turn off generalized ceiling lights accordingly. Example: All lights of a classroom are not needed for teacher working alone.

9. Outside lighting should be minimized. Security lighting should be controlled by a timer or photo-cell. Individual security needs should be evaluated.

10. Request maintenance department to remove bulbs, ballasts, and/or light fixtures that are not needed for recommended (lighting) foot-candle levels.

11. Request maintenance staff to schedule cleaning and maintenance of light fixture interiors and lenses.

BUILDING OPERATION - MAINTENANCE AND MISCELLANEOUS

1. Proper maintenance is a very essential component of an energy conservation program.

2. Principals should report promptly any malfunction of building components, mechanical systems or controls.

3. Maintain security of all locked thermostats and all control panels.

4. Filters should be changed as scheduled on air handling equipment. As filters get dirty, equipment can become more inefficient on air conditioning. On heating, hot air may not be circulated as needed.

5. Observe that dampers are maintained in tightly fitting condition on all exhaust fans and louvers through outside walls.

6. Foundation vents to underfloor spaces and attic vents should be closed securely during heating season, open remainder of the year.

7. Shower heads should have low flow adapters installed to conserve water.

8. Water coolers, freezers, water heaters, etc., which are not used in the summer should be turned off. Safety should be a consideration when leaving freezer doors, etc., open.

9. Proper operation of the kitchen is very important in conserving energy. If on an electrical demand meter, develop a schedule of operation of electrical kitchen equipment which will reduce the peak load demand to the minimum possible.

10. Cafeteria personnel should not use cooking equipment to heat kitchen.

11. Dishwashers should be completely loaded when using. Other cooking equipment should not be left on unnecessarily.

12. Cafeteria lights should be kept off if not needed. Exhaust fans should not be run when not needed.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING MAINTENANCE AND RENOVATION

Controls: HVAC

Well maintained, adequate controls are a significant factor in efficient operation and energy consumption. Evaluation of control systems and the application of a policy of manual operation must usually be done on an individual building basis. Since building envelope problems such as poor insulation, area of glass, orientation of walls, etc. have a direct affect on controls, any remodeling projects should be designed as a total system - not considered simply as a "controls problem."

1. All freeze protection thermostats should have a locking cover or other means to prevent any tampering or resetting inadvertently, resulting in wasted fuel.

2. A six-hour mechanical timer is recommended for use as a clock by-pass rather than a toggle switch, to prevent inadvertent overheating, and selective zone operation.

3. Fresh air intakes should be closed to a minimum position for heating season on air handling units, consistent with new code requirements for intake; approximately 3.3 CFM per student. Fresh air is not needed during non-operating hours.

4. Check motorized valves and individual room thermostats for proper operation. Encourage teachers to report problems immediately.

5. Thermostats should have a locking cover and be located in a secure area. Setting and control of thermostats should be restricted to those persons designated by Board of Education Policy.

6. Add and/or replace thermostat controls as needed to maintain efficiency. Check periodically for proper operation.

7. Seven-day clocks can be reset seasonally to take advantage of the shorter warm-up time required in the spring and fall. Manual override in response to changes of weather (temperature, sunshine, etc.) is very desirable.

8. Add seven-day clocks to each mobile classroom HVAC unit.

9. Install a centralized panel convenient to the principal's office, containing necessary override switches, timers, etc., for better control of HVAC systems.

10. Where applicable, and economically feasible, add motorized valves and thermostats in each room for individual room control. Engineering consultation is recommended.

11. Add a switch on shop overhead doors to switch off shop heating system when door is open.

12. On buildings where applicable, insure that controls are adequate to prevent unnecessary heating during cooling season, and unnecessary cooling during the heating season.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING MAINTENANCE AND RENOVATION

Hot Water and Steam Boiler Systems

1. Boiler room inspections should be made daily or as frequently as needed by technical personnel to maintain equipment.

2. Burners should be adjusted for maximum possible combustion efficiency.

3. Steam lines and/or hot water lines should be insulated in all boiler rooms and unheated areas.

4. Boiler rooms should be in first-class condition and have adequate insulation, a weatherstripped door and a combustion air vent which is protected from excess infiltration of cold air. Heat should be conserved in the boiler room to prevent freezing.

5. When a complete building is on one zone, adding equipment and controls for additional zones will improve heat distribution, and reduce fuel consumption.

6. Where heat to various spaces within the heating zone are not balanced, adding more zones or other control equipment will reduce fuel used. Engineering consultation is recommended.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING MAINTENANCE AND RENOVATION

HVAC Systems - Electrically Heated Buildings

1. Inspect on a regular schedule all filters for cleaning and/or replacement.

2. Roof top units need periodic inspection, since they are exposed to outside environmental forces. Schedule inspections of all equipment.

3. Inspect and correct, if necessary, controls on fresh air intakes for maximum efficiency during cold weather. Fresh air is not generally needed or desirable during non-occupancy hours.

4. Determine electrical peak load demand profiles and evaluate controls and other methods for reducing peak electrical loads. This is most critical when on demand billing.

5. Where systems use the space above the ceiling as the return air passage, in order to reduce the heat loss through the roof, adding insulation and/or a return air duct system should be evaluated.

6. When a complete building is on one zone, adding more zones will usually improve HVAC distribution and reduce energy use. Evaluate individual building usage, conditions, solar orientation, and economic pay-back of investment.

7. Where various spaces within the zones are not properly balanced, improved balance will usually reduce consumption of energy.

8. Some building envelopes are not compatible with efficient operation of electrical heat and/or cooling equipment. More insulation is needed in ceiling and walls. Solar gain during cooling season, from windows and skylights, should be reduced to a minimum. See notes under Building Envelope.

9. Maintain controls carefully, and be sure to have time clocks and thermostats set for night set-back. Evaluate adequacy and efficiency of control systems. Engineering consultation is advised.

10. Review rate schedules with your local power company representative. Be sure to understand thoroughly the best means of operation to minimize costs. Evaluate peak load management procedures and devices if building is on a demand meter. Engineering consultation is advised.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING MAINTENANCE AND RENOVATION

Lighting

Since lighting is used the full school year, significant savings can be achieved by switching off lights in areas having adequate natural light. The eye adapts to various light levels quickly and becomes comfortable. Many areas are in excess of recommended foot-candle levels. Areas most often overlighted are cafeterias, entrances, corridors, and some offices and classrooms. Check areas with a foot-candle meter.

1. Replace higher watt bulbs (100, 150, 200) with lower wattage bulbs, in spaces such as cafeterias, conference rooms, closets, corridors and toilets where lower light levels are adequate. Use 60, 75 or 100 watt bulbs.

2. Replace incandescent lighting with fluorescent fixtures where appropriate. Use foot-candles now recommended as adequate. Results are better distribution of light and less electricity consumption. Existing wiring can, in most cases, be reused. This item has a relatively short pay-back of investment.

3. Remove bulbs, ballasts and/or light fixtures that are not needed for recommended (lighting) foot-candle levels. Check areas with a foot-candle meter.

4. In gymnasiums (particularly those with high usage) replace incandescent fixtures with metal halide or mercury vapor fixtures. Arrange circuits with switches to allow selection of different levels (foot-candles) of illumination uniformly over exercise area.

5. In all instructional spaces where all lights are on one switch, rewire to divide circuit control. Each room should have a separate circuit along the windows. Also, in four tubes-2 ballast fixtures, divide each room into two circuits, (2 tubes of each fixture).

6. Install supplementary lamps at point of need for fixed location tasks such as study carrels, drafting tables, teachers' desks, shop tools, library book shelves, displays, etc. Remove or switch off generalized ceiling lights accordingly.

7. Outside lighting should be minimized, consistent with security. Security lighting should be controlled by a timer or photo-cell.

GENERALIZED RECOMMENDATIONS FOR CONSERVATION OF ENERGY

BUILDING MAINTENANCE AND RENOVATION

Building Envelope: Roofs, Ceilings, Walls, and Floors

Routine maintenance of the basic structure is a major factor in preventing costly major repairs. Roof leaks should be repaired because wet insulation is ineffective. Exterior air leakage should be stopped by patching, caulking or weatherstripping as appropriate. Air leakage may be a major percentage of total heat loss.

Buildings should be evaluated for future useful life. Only retrofitting projects which are critical or have short pay-back periods should be recommended for buildings having a relatively short projected life. Economic pay-back data and life-cycle cost data should be considered for all projects. Additional information and design consultation is advised before action is taken on the following items:

1. If a structure is scheduled to be re-roofed, also evaluate making improvements in the roof-ceiling system insulation (R valves). The first inch of insulation has the shortest pay-back time.

2. Evaluate adding batt type insulation to existing suspended acoustical tile lay-in ceiling where appropriate.

3. Evaluate adding appropriate type insulation to existing uninsulated attic space, where needed. The first six inches of insulation has a short pay-back time.

4. When adding new acoustical tile lay-in ceiling system, consider a maximum classroom ceiling height of approximately 10 feet, offset if needed at window heads.

5. Where attic spaces need improved ventilation, evaluate adding a thermostatically controlled exhaust fan.

6. Radiation of body heat to cold outside wall, floor, and window surfaces is very apparent in cold weather. In buildings with brick and concrete masonry walls, (with no insulating material in the cavities), consideration should be given to improving the heat flow resistance (R) of these walls. Alternative methods should be evaluated.

7. Seal or caulk all air leaks in exterior building enclosure. This may be a major loss.

8. Special attention should be directed to achieving low energy cost operation in remodeling or addition projects. Special attention should be directed to the glass and how and where it is used. Double (insulated) glass is generally an excellent investment.

9. Add enclosures around base of mobile units, to reduce heat losses through floors. Place units on south or east side of building if possible, with long sides having south and north orientation.

Building Envelope: Roofs, Ceilings, Walls, Floors (Continued)

10. Passive solar designs and methods, such as heat storage in mass of walls, floors, roofs, and partitions, solar gain through double glazed south facing windows, should be evaluated for each existing building.

11. If windows are scheduled for replacement, consideration should be given to reducing the total glass area (particularly on the west and north exposures), if area is excessive. Evaluate the quality of the replacement windows. Operating thermal break frames and double glazing are generally an excellent investment.

12. In buildings with no scheduled window replacement, if windows are leaking, install weatherstripping and caulk cracks where needed.

13. In buildings with a very high percentage of glass, (in the east, west or north walls), a significant amount of heat loss occurs through the windows. Reduction of heat loss can be accomplished by removing part of the windows and closing that area with an insulated wall or panel.

14. Where architecturally appropriate, consider adding vestibule doors at main traffic entrance doors. Weatherstrip head, jamb, and threshold, as needed.

15. Replace damaged exterior doors with insulated metal type, where appropriate. Weatherstrip jamb, head and threshold of all exterior doors, to stop infiltration. Check closers for proper operation.

16. On south or west facing windows, where there is no overhang or shading devices, solar gain may cause extreme overheating of that space. Evaluate alternative shading devices, including planting deciduous trees.

17. On south, south-east and south-west windows only, roof overhang and wall projections do provide good shading in summer, spring and fall, allowing solar heat to come into glass in the winter. When no overhang is possible, solar screening devices are effective on south windows. Deciduous trees are also effective.

18. On east windows, with no shading protection, adjustable interior shades or blinds may be effective for the shorter time periods of sunlight exposure. Early morning sunlight is often desirable, if controlled.

19. Evaluate window and door placement in each space for use in natural flow of ventilating and cooling air from prevailing breezes. Wind break plantings on the west and north exposures reduce building surface air velocity, heat loss, and infiltration pressure.

20. Skylights which are in desirable locations, should be evaluated for advantages of natural light and solar gain, and disadvantages of heat loss. Double glazed types are recommended.

SCHEDULE GA (NC)

GENERAL SERVICE, ALL-ELECTRIC

AVAILABILITY (North Carolina Only)

Available only to establishments in which environmental space conditioning is required and all energy for all such conditioning is supplied electrically through the same meter as all other electric energy used in the establishment, provided however that if any such establishment contains residential housekeeping units, all energy for all water heating and cooking for such units is also supplied electrically.

Service under this Schedule shall be used solely by the contracting customer in a single establishment, located entirely on a single, contiguous premises, and all electric energy used in the establishment must be provided by the Company.

To qualify for service under this Schedule, space conditioning systems shall be permanently installed in accordance with sound engineering practices and the manufacturer's recommendation.

This Schedule is not available for auxiliary or breakdown service, and power delivered hereunder shall not be used for resale or exchange or in parallel with other electric power, or as a substitute for power contracted for or which may be contracted for, under any other schedule of the Power Company, except at the option of the Company, under special terms and conditions expressed in writing in the contract with the Customer.

The obligations of the Company in regard to supplying power are dependent upon its securing and retaining all necessary rights-of-way, privileges, franchises and permits, for the delivery of such power, and the Company shall not be liable to any customer or applicant for power in the event it is delayed in, or is prevented from furnishing the power by its failure to secure and retain such rights-of-way, rights, privileges, franchises, and permits.

TYPE OF SERVICE

The Company will furnish 60 Hertz service through one meter, at one delivery point, at one of the following approximate voltages, where available:

Single phase, 120/240 volts; or
3 phase, 208Y/120 volts, 460Y/265 volts; or
3 phase, 3 wire, 240, 460, 575, or 2300 volts; or
3 phase, 4160Y/2400, 12470Y/7200 or 24940Y/14400 volts; or
3 phase voltages other than the foregoing, but only at the Company's option, and provided that the size of the Customer's contract warrants a substation solely to serve that Customer, and further provided that the Customer furnish suitable outdoor space on the premises to accommodate a ground-type transformer installation, or substation, or a transformer vault built in accordance with the Company's specifications.

The type of service supplied will depend upon the voltage available. Prospective customers should ascertain the available voltage by inquiry at the nearest office of the Company before purchasing equipment.

Motors of less than 5 H.P. may be single-phase. All motors of more than 5 H.P. must be equipped with starting compensators and all motors of more than 25 H.P. must be of the slip ring type except that the Company reserves the right, when in its opinion the installation would not be detrimental to the service of the Company, to permit other types of motors.

RATE:

For the First 125 Kwh per KW Billing Demand per Month:

$7.69 plus .1959 cents per Kwh for the first	100 Kwh
5.7059 cents per Kwh for the next	1,170 Kwh
4.7459 cents per Kwh for the next	1,730 Kwh
4.1859 cents per Kwh for the next	27,000 Kwh
4.0159 cents per Kwh for the next	30,000 Kwh
3.8959 cents per Kwh for the next	30,000 Kwh
3.1959 cents per Kwh for the next	910,000 Kwh
3.1859 cents per Kwh for all over	1,000,000 Kwh

(Schedule GA (NC) Continued)

RATE (Continued)

For the Next 275 Kwh per KW Billing Demand per Month:

2.3459 cents per Kwh for the first	140,000 Kwh
2.1459 cents per Kwh for the next	60,000 Kwh
1.9759 cents per Kwh for all over	200,000 Kwh

For all Over 400 Kwh per KW Billing Demand per Month:

1.9759 cents per Kwh for the first	1,000,000 Kwh
1.8959 cents per Kwh for all over	1,000,000 Kwh

APPROVED FUEL CHARGE

The Company's approved fuel charge over or under the Rate set forth above, if any, pursuant to North Carolina General Statute 62-134 (e) will apply to all service supplied under this Schedule.

DETERMINATION OF BILLING DEMAND

The Demand for billing purposes each month shall be the maximum integrated thirty-minute demand measured during the month for which the bill is rendered, but not less than 50 per cent of the maximum monthly demand during the previous 12 months, including the month for which bill is rendered, nor less than 50 per cent of the contract demand, nor less than 15 KW; however, the minimum billing demand for contracts made prior to March 15, 1971 shall be 5 KW until the maximum integrated thirty-minute demand measured during the month for which the bill is rendered becomes 15 KW or more, after which time the minimum billing demand on such contracts shall be 15 KW.

MINIMUM BILL

The minimum bill shall be $.80 per KW of the billing demand.

The Company may establish an annual minimum bill, in lieu of a monthly minimum bill. The annual minimum bill shall be $16.50 per KW of demand determined (1) by a count of connected load in KW adjusted for the effect of diversity, (2) by the contract demand or by the maximum monthly demand recorded in the previous contract year, whichever is the larger, or (3) in consideration of special or unusual characteristics of the type service requested. Unless otherwise specified by long form contract, the billing procedure will be as follows: If no energy is used during certain months of the contract year, no monthly minimum will be billed. During months when energy is used, the total of the bills rendered will be credited to the annual minimum. At the end of the contract year, the Company will bill the customer the difference between the annual minimum and the total of the monthly bills, if such total is less than the annual minimum. If the total of the monthly bills exceeds the annual minimum, the last bill of the contract year will include only the amount of energy used during the month for which bill is rendered.

POWER FACTOR CORRECTION

When the average monthly power factor of the customer's power requirements is less than 85 per cent, the Company may correct the integrated demand in kilowatts for that month by mulitplying by 85 per cent and dividing by the average power factor in per cent for that month.

PAYMENT

Bills under this Schedule are due and payable on the date of the bill at the office of the Company. Bills are past due and delinquent on the fifteenth day after the date of the bill. If any bill is not so paid, the Company has the right to suspend service. In addition, all bills not paid by the twenty-fifth day after the date of the bill shall be subject to a one per cent (1%) late payment charge on the unpaid amount. This late payment charge shall be rendered on the following month's bill and it shall become part of and be due and payable with the bill on which it is rendered.

CONTRACT PERIOD

Each customer shall enter into a contract to purchase electricity from the Company for a minimum original term of one (1) year, and thereafter from year to year upon the condition that either party can terminate the contract at the end of the original term, or at any time thereafter, by giving at least sixty (60) days' previous notice of such termination in writing; but the Company may require a contract for a longer original term of years when the requirement is justified by the circumstances.

INTERRUPTIBLE POWER PROVISIONS

For customers who enter into a specific contract for interruptible power service, the following provisions apply in addition to the above provisions of this Schedule.

(Schedule GA (NC) Continued)

INTERRUPTIBLE POWER PROVISIONS (Continued)

1. Load Limitations:

Contracts for interruptible power service will be accepted by the Company on the basis of successive contracts, and each contract shall specify an interruptible, integrated demand of at least 5,000 KW, but not more than 20,000 KW, to be subject to these provisions. The Company shall limit the acceptance of contracts to a total of 100,000 KW of total system interruptible load on all non-residential Schedules. Future contracts providing for replacement loads will be considered in order to maintain the availability of 100,000 KW capacity to the Company.

2. Definitions:

Contract Demand: The Contract Demand is the maximum kilowatt demand which the Company shall be required to supply to the Customer, and is the sum of the Interruptible Contract Demand with limited periods of availability, and the Firm Contract Demand with an unlimited period of availability.

Interruptible Contract Demand: The Interruptible Contract Demand of at least 5,000 KW, but not more than 20,000 KW, is that portion of the Contract Demand which the Company will supply to the Customer at all times except during Interruption Periods.

Firm Contract Demand: The Firm Contract Demand is that portion of the Contract Demand which the Company will supply to the Customer without limitation on the periods of availability.

Interruption Period: Interruption Period is that interval of time, initiated and terminated by the Company in one or more notices, during which the Customer will require service at no more than the Firm Contract Demand and the Company is obligated to supply no more than the Firm Contract Demand.

Penalty Demand: The Penalty Demand is the maximum five (5) minute integrated demand required by the Customer during an Interruption Period in excess of the Firm Contract Demand.

Exposure Period: The Exposure Period is that period of time within the month corresponding to the weekday peak demand periods and during which interruption under these provisions is most likely to occur. Specifically, the Exposure Period for the purpose of computing monthly credits is defined as follows:

Summer Months of June through September—
11 A.M. to 10 P.M., Monday through Friday

Winter Months of October through May—
6 A.M. to 9 P.M., Monday through Friday

3. Notice to Control Load:

The Customer shall be notified of all initiations and terminations of an Interruption Period at least ten (10) minutes prior to such times, and, the Customer shall fully comply with the Company's requests to reduce and maintain his load to not more than the Firm Contract Demand for the duration of the Interruption Period.

4. Interruptible Power Categories:

The Customer shall specify the availability of his interruptible load by selecting one of the following categories:

Interruptible Power Category	Maximum Annual Hours of Interruption	Maximum Hours of Interruption in Five (5) Years
1	200	750
2	400	1500
3	600	2250

The Company may invoke interruption periods for not more than the number of hours so designated. Further, the Company shall have the right to invoke an interruption period at any time, subject to a maximum duration of 15 hours in any calendar weekday, which may be extended only by mutual agreement with the Customer.

(Schedule GA (NC) Continued)

INTERRUPTIBLE POWER PROVISIONS (Continued)

5. Credit and Credit Computation:

Each month, a measurement of the interruptible capacity available to the Company will be made in order to compute a credit. All energy consumed at a level above the Firm Contract Demand, but below the Contract Demand, in those hours designated as Exposure Period, excluding the aggregate of such energy consumed during Interruption Periods, will be divided by the hours of Exposure Period excluding hours during Interruption Periods, to derive the Effective Interruptible Demand (EID). The EID thus computed will be reduced by the amount of the monthly maximum demand above the Firm Contract Demand which occurs during any Interruption Period, provided that the EID will not be less than zero.

The formula for computation is:

$$EID = \frac{KWH_{EP} - KWH_{IP}}{Hours_{EP} - Hours_{IP}} - KW_{MP}$$

Where: EID = Effective Interruptible Demand

KWH_{EP} = Energy consumed during Exposure Periods

KWH_{IP} = Energy consumed during Interruption Periods

$Hours_{EP}$ = Hours of Exposure Periods

$Hours_{IP}$ = Hours of Interruption Periods

KW_{MP} = Maximum monthly Penalty Demand

The amount of credit to be applied to the Customer's account each month will be determined by the formula:

$$Credit = EID \times \$/KW_{EID}$$

Where: $\$/KW_{EID}$ is a value from the following table:

Interruptible Power Category	$\$/KW_{EID}$
1	$0.85
2	$1.20
3	$1.50

6. Penalty and Penalty Computation:

Should the Customer fail to reduce and maintain his load at, or below, the Firm Contract Demand during any Interruption Period, a penalty will be applied to the Customer's account in the month of occurrence. The penalty shall be computed by the formula:

$$Penalty = \Sigma KW_P \times \$1.05$$

Where: ΣKW_P = the summation of the individual Penalty Demands occurring in each and every Interruption Period during the billing period.

7. Contract Period:

Contracts with interruptible load provisions shall be for a minimum original term of five (5) years and thereafter until terminated, by giving at least thirty (30) months' previous notice of such termination in writing, but the Company may require a contract for a longer original term of years where the requirement is justified by the circumstances.

The Company reserves the right to terminate the Customer's contract containing the interruptible load provisions at any time upon written notice to the Customer in the event that the Customer violates any of the terms or conditions of this Schedule or where the Effective Interruptible Demand (EID) is less than 50% of the Interruptible Contract Demand for two (2) consecutive months. In the event of early termination of a contract with interruptible load provisions, the Customer will be required to pay the Company for the costs due to such early cancellation.

Appendix C

GLOSSARY

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AMORTIZATION

The gradual reduction (or accumulated provision or reserve therefor) of an amount in an account by prorating such amount over a predetermined period, such as the life of the asset or liability to which it is applied, over the period during which it is anticipated the benefit will be realized.

AUTOMATIC ADJUSTMENT CLAUSE

A fee added to a customer's bill to compensate the utility for changes in the cost of service other than fuel cost (see Fuel Adjustment Clause).

AUTOMATIC METER READING SYSTEM

A system capable of reading a utility meter, preparing and conditioning the data and transmitting it from the meter location to a central data accumulation device. The communications link may be radio, telephone line, power line carrier, direct cable or a combination thereof. The data accumulation device will in most cases be a computer.

AVAILABILITY FACTOR

The ratio of the time (in hours) during which a unit or major equipment is available for service, divided by the total period hours.

BASELOAD

That part of the utility's load (kw) that is supplied usually by large, efficient power plants, e. g., coal or nuclear generation plants, or the minimum load over a given period of time.

BTU (BRITISH THERMAL UNIT)

The standard unit for measuring quantity of heat energy, such as the heat content of fuel. It is the amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit at sea level.

CAPABILITY

The maximum load which a generating unit, generating station or other electrical apparatus can carry under specified conditions for a given period of time, without exceeding approved limits of temperature and stress.

CAPABILITY MARGIN

The difference between net system capability and system maximum load requirements (peakload), is the margin of capability available to provide for scheduled maintenance, emergency outages, system operating requirements and unforeseen loads.

CAPACITY

The load for which a generating unit, generating station or other electrical apparatus is rated either by the user or by the manufacturer.

CAPACITY FACTOR

The ratio of total electric generation (in kwh) supplied by a unit, plant or system, divided the product of by the number of hours in the period considered times the maximum dependable capacity (in kw).

COMMERCIAL AND INDUSTRIAL CLASSES

A customer, sales, and revenue classification covering energy supplied for commercial and industrial purposes. Usually subdivided into Commercial and Industrial or into Small Light and Power and Large Light and Power. Most companies classify Commercial or Industrial customers using the Standard Industrial Classification or kwh use as yardsticks; others classify Industrial customers as those whose demands or annual use exceeds some specified limit. These limits are generally based on a utility's rate schedules.

CROSS ELASTICITY OF DEMAND

The percentage change in the quantity demanded of one good, A, resulting from a one percent change in the price of another good, B. If the cross elasticity of demand is greater than zero, A and B are said to be substitutes; if the cross elasticity is less than zero, A and B are said to be complements.

CUSTOMER COSTS

Those costs which vary with the number of customers served and are independent of the amount of energy used or demanded. These costs include the annual carrying charges and operating expenses associated with the secondary distribution system, service drop, and meter. The customer costs are commonly recovered in the electric bill as a fixed charge or minimum monthly charge.

CUSTOMER (ELECTRIC)

A customer is an individual, firm, organization, or other electric utility which purchases electric service at one location under one rate classification, contract, or schedule.

CUSTOMER (INDIRECT) LOAD MANAGEMENT SYSTEM

A control system operated by the customer that reduces the customer's electric load to improve the customer's load factor.

DEFERRABLE LOAD

A load which can be changed from one time period to another (usually from peak to offpeak periods).

DEMAND

The rate at which electric energy is delivered to a user expressed in kilowatts, kilovolt-amperes or other suitable unit at a given instant or averaged over any designated period of time. The primary source of "demand" is the power-consuming equipment of the customers. See LOAD.

Annual Maximum (Peak) -- The greatest of all demands of the load under consideration which occurred during a prescribed demand interval in a calendar year.

Annual System Maximum (Peak) -- The greatest demand on an electric system during a prescribed demand interval in a calendar year.

Average -- The demand as determined by dividing the total number of kilowatt-hours by the number of units in the time interval.

Coincident -- The sum of two or more demands which occur in the same demand interval.

Coincident Maximum -- The maximum sum of two or more individual demands occurring in the same demand interval for a given period of time.

Maximum (Peak) -- The greatest of all demands of the load under consideration which has occurred during a specified period of time.

Noncoincident -- The sum of two or more individual demands which do not occur in the same demand interval. Meaningful only when considering demands within a limited period of time, such as a day, week, month, a heating or cooling season, and usually for not more than one year.

Shoulder Peak -- The demand that occurs immediately before and after the peak demand.

DEMAND CHARGE

Those charges which reflect the costs associated with the use of production facilities needed to supply the customer with electricity. Demand or capacity costs vary with the amount of capacity (kw) required for the utility to meet its peak demand. The capital costs of generating stations and transmission lines constitute a major portion of these costs. Demand costs are frequently billed according to the maximum demand registered during a specified period; e.g., year, month, diurnal period.

DEMAND INTERVAL

The period of time during which the electric energy flow is averaged in determining demand, such as 60-minute, 30-minute, 15-minute, or instantaneous.

DEPRECIATION

Charges made against income to provide for distributing the cost of depreciable plant, less estimated net salvage over the estimated useful life of the asset (using mortality turnover or other appropriate methods), in such a way as to allocate it as equitably as possible to the period during which services are obtained from the use of facilities. Among the factors to consider are: wear and tear, decay, inadequacy, obsolescence, changes in demand, and requirements of public authorities.

DISPATCHING

The operating control of an integrated electric system involving operations such as (1) the assignment of load to specific generating stations and other sources of supply to effect the most reliable and economical supply as the total of the significant area loads rise or fall; (2) the control of operations and maintenance of high voltage lines, substations, and equipment, including administration safety procedures; (3) the operation of principal tie lines and switching; and (4) the scheduling of energy transactions with connecting electric utilities.

DISTRIBUTION

The act or process of distributing electric energy from convenient points on the transmission or bulk power system to the consumers. Also a functional classification relating to that portion of utility plant used for the purpose of delivering electric energy from convenient points on the transmission system to the consumers, or to expenses relating to the operation and maintenance of distribution plant.

DIVERSITY

That characteristic of a variety of electric loads whereby individual maximum demands usually occur at different times. Diversity among customers' loads results in diversity among the loads of distribution transformers, feeders, and substations, as well as between entire systems. See LOAD DIVERSITY.

DIVERSITY FACTOR

The ratio of the sum of the noncoincident maximum demands of two or more loads to their coincident maximum demand for the same period. It will always be greater than or equal to one.

EMBEDDED COSTS

Refer to average accounting costs or sunk costs. When determining the embedded costs of generating a kilowatt of electricity, the costs of providing capacity that were incurred, say, 20 years ago are averaged with the costs of providing the most recent capacity additions. A projected embedded cost method considers a forward test year and reflects projected operating costs for that year, but a projected embedded cost study still reflects sunk or historical capacity valued in historical dollars. Embedded costs are typically "fully distributed."

ENERGY CHARGE

Those charges reflecting costs that vary by level of electric energy (kwh) supplied, as contrasted with the demand charge. Fuel costs account for a principal part of energy charges. Energy costs can increase as less efficient generating capacity is brought in use.

ENERGY, ELECTRIC

As commonly used in the electric utility industry, electric energy means kilowatt-hours.

OffPeak -- Energy supplied during periods of relatively low system demands, as specified by the supplier.

OnPeak -- Energy supplied during periods of relatively high system demand, as specified by the supplier.

FORCED OUTAGE RATE

The ratio of forced outage hours to the sum of forced outage hours plus service hours. A forced outage is the occurrence of a component failure or other condition that requires that the equipment be removed from service.

FUEL ADJUSTMENT CLAUSE

A fee, also called a "passthrough," added to a customer's electric bill to compensate the utility for changes in the cost of generation fuels.

FULLY-DISTRIBUTED COSTS - SEE "EMBEDDED COSTS"

FUNCTIONAL ACCOUNTS

Groupings of plant and expense accounts according to the specified function or part they play in the rendition of utility service.

Electric Utility Plant Functional Accounts -- Includes Intangible, Production, Transmission, Distribution, and General Plant.

Operation and Maintenance Functional Expense Accounts -- Includes Power Production, Transmission, Distribution, Customer Accounts, Sales, and Administrative and General Expenses.

GENERATING UNIT

The equipment used to produce electric power. This includes the boiler, turbo-generator and associated equipment. Generating equipment can be classified as follows:

Baseload Unit -- A unit which is normally operated to carry baseload and which operates essentially at a constant load.

Cycling (Intermediate) Unit -- A unit which is used to follow load demand between base and peak load periods.

Peaking Unit -- A unit which is operated normally at short time intervals to provide power and energy during high energy use (peak) periods.

GIGAWATT-HOUR (gwh)

1,000,000 kilowatt-hours (kwh) (defined herein).

INCREMENTAL COSTS (ENERGY)

The increase in cost of generating or transmitting additional electricity above some previously determined base amount.

INVERSE ELASTICITY RULE

Applies to situations where marginal cost pricing is used to develop rates and the funds generated from those rates do not exactly satisfy the revenue requirement. The rule prescribes the following solution: In the event of a revenue surplus (shortfall), each customer class' rate should be adjusted downward (upward) from its marginal cost in inverse proportion to its price elasticity of demand for electricity.

KILOWATT (kw)

1,000 watts (defined herein)

KILOWATT HOUR (kwh)

The basic unit of electric energy equal to one kilowatt of power supplied to or taken from an electric circuit steadily for one hour.

LOAD

The amount of electric power delivered or required at any specified point or points on a system. Load originates primarily at the power consuming equipment of the customers. See DEMAND.

LOAD CURVE

A curve showing power (kilowatts) supplied, plotted against time of occurrence, and illustrating the varying magnitude of the load during the period covered. This curve presents the load pattern of the utility's customers over the specified time period.

LOAD DIVERSITY

The difference between the sum of the maxima of two or more individual loads and the coincident or combined maximum load, usually measured in kilowatts.

LOAD DURATION CURVE

A curve showing cumulative levels of kilowatt demand plotted against the cumulative number of hours (by day, by week, by month or by year).

LOAD FACTOR

The ratio of the average load in kilowatts supplied during a designated period to the peak or maximum load in kilowatts occurring in that period; e.g., if the January load factor for A is 100 percent, A's average load equals its maximum load and A uses the same number of kilowatts at all times during the month of January.

LOAD MANAGEMENT

Techniques designed to level the time patterns of electricity generation.

LONG RUN INCREMENTAL COST (LRIC)

One variant of long run marginal cost (see Marginal Cost). It reflects the change in total costs caused by producing an additional unit of output.

LOSS (LOSSES)

The general term applied to energy (kilowatt-hours) and power (kilowatt) lost in the operation of an electric system. Losses occur principally as energy transformations from kilowatt-hours to waste heat in electrical conductors and apparatus.

MAINTENANCE EXPENSES

A portion of Operating Expenses--includes labor, materials, and other direct and indirect expenses incurred for preserving the operating efficiency or physical condition of utility plant used for power production, transmission and distribution of energy, and administrative and general operations.

MARGINAL COST

Short Run -- The change in the total variable cost of operating existing capacity (which includes any sacrifice of future value or any future realization of higher costs that are casually attributable to present production) caused by producing an additional unit of output. (In the short run, the firm has both variable and fixed costs.)

Long Run -- The change in total costs (which include renewal, replacement and expansion costs) caused by producing an additional unit of output. (In the long run, all costs are variable.)

MEGAWATT (MW)

1,000 kilowatts.

OPERATING AVAILABILITY

The number of hours during which a piece of equipment is available for service, whether or not it is actually in service, divided by the number of hours in the period under consideration.

OPERATING EXPENSES

Expenses related to utility operations and composed of: Operation Expense, Maintenance Expense, Provisions for Depreciation and Amortization, Taxes Other Than Income Taxes, Income Taxes, Provision for Deferred Income Taxes, Income Taxes Deferred in Prior Years - Credit, and Investment Tax Credit Adjustments - Net.

OPERATING INCOME

Operating Revenues less Operating Expenses.

OPERATING REVENUES

The amounts billed by the utility for utility services rendered and for other services incidental thereto.

PEAK

See DEMAND, MAXIMUM.

PEAK LOAD

See DEMAND, MAXIMUM.

POWER, ELECTRIC

The time rate of generating or using electric energy, usually expressed in kilowatts.

Firm -- Power or power-producing capacity intended to be available at all times during the period, even under adverse conditions.

Interruptible (Non-firm) -- Power made available under agreements which permit curtailment or cessation of delivery by the supplier.

POWERPOOL

A powerpool is two or more interconnected electric utility systems planned and operated to supply power by contractual agreement in the most reliable and economic manner for their combined load requirements and maintenance program.

PRICE ELASTICITY OF DEMAND

The percentage change in quantity demanded of a commodity (e.g., electricity) resulting from a one percent change in its price. The absolute value of the calculated coefficient (E) may range from zero to infinity. It may take any of five forms: (1) perfectly elastic (E = inf.); (2) relatively elastic (E > 1); (3) unit elastic (E = 1); (4) relatively inelastic (E < 1); and (5) perfectly inelastic (E = 0).

PRODUCTION

The process of generating electric energy. Also a functional classification relating to that portion of utility plant used for the purpose of generating electric energy, or to expenses relating to the operation or maintenance of production plant, or the purchase and interchange of electric energy.

RATE BASE

The value of property established by a regulatory authority, upon which a utility is permitted to earn a specified rate of return. Generally, this represents the value of property used by the utility in providing service and may be calculated by the following accounting methods combinations thereof: fair value, prudent investment, reproduction cost, or original cost. Depending on which method is used, the rate base includes cash working capital, materials and supplies, and deductions for: accumulated provision for depreciation, contributions in aid of construction, customer advances for construction, and accumulated deferred income taxes and accumulated deferred investment tax credits.

RATE DESIGN

Refers to the shape of the total rate schedule and is a function of the load characteristics of the customer classes and the utility's demand, energy and customer cost components. Examples of rate form include declining block, time of day and inverted.

RATE LEVEL

Refers to the amount or magnitude of a rate in a specific rate form. For example, assuming a flat rate of $0.06 per kwh, the rate level is $0.06.

RATEMAKING

The process of designing and applying a rate form and rate level.

RATE OF RETURN ON COMMON EQUITY

Net income less preferred stock dividends divided by common stock equity.

RATE OF RETURN ON RATE BASE

The ratio of allowed Operating Income to a specified rate base, expressed as a percentage.

RATE STRUCTURE

Synonymously used with rate design. Describes how a revenue level is collected from users or customers. Total rate structure includes both rate form and rate level.

RELIABILITY

The probability that a piece of equipment will function without failure over a specified period of time for the amount of usage.

RESERVE MARGIN

The difference between dependable capacity of the system including firm power purchases and the actual anticipated peak load in a specified period.

RESIDENTIAL CLASS

A customer, sales, and revenue classification covering electric energy supplies for residential (household) purposes. The classification of an individual customer's account where the use is both residential and commercial is based on principal use.

REVENUE REQUIREMENT

The total annual revenue that a utility is entitled to take is decided upon by the commission and modified by automatic adjustment clauses. The revenue requirement is the sum of the estimated operation and maintenance expenses, depreciation, taxes, and a reasonable return on an appropriate rate base to cover the cost of capital invested in the utility company.

RIPPLE CONTROL SYSTEM

Equipment installed on an electrical transmission network to super-impose on the power line a frequency/time coded message which is interpreted as command signals by remotely-located receiver relay devices.

SUBSTATION

A substation is an assemblage of equipment designed for switching and/or changing or regulating the voltage of electricity. Service equipment, line transformer installations, or minor distribution or transmission equipment are not classified as substations.

SYSTEM, ELECTRIC

The physically connected generation, transmission, distribution, and other facilities operated as an integral unit under one control, management, or operating supervision.

TIME-OF-DAY METERING

A method or system for recording kilowatt-hours consumed, or a maximum demand established during a specified period of time (onpeak) in addition to the offpeak energy consumed in a day.

TRANSMISSION

The process of transporting electric energy in bulk from a source or sources of supply to other principal parts of the system or to other utility systems. Also a functional classification relating to that portion of utility plant used for the purpose of transmitting electric energy in bulk to other principal parts of the system or to other utility systems, or to expenses relating to the operation and maintenance of transmission plant.

VALUE-OF-SERVICE

Refers to the conditions of demand which characterize the different segments of a utility's market. Whereas cost analyses look to conditions on the supply side of the market, consideration of value-of-service factors give recognition to the demand side of the market. Value-of-service is not subject to precise measurement.

VOLT

The unit electromotive force or electric pressure, analogous to water pressure, in pounds per square inch. It is the electromotive force which, if steadily applied to a circuit having a resistance of one ohm, will produce a current of one ampere.

WATT

The electrical unit of power or rate of doing work. The rate of energy transfer equivalent to one ampere flowing under a pressure of one volt at unit power factor. It is analogous to horsepower or foot-pounds per minute of mechanical power. One horsepower is equivalent to approximately 746 watts.

WORKING CAPITAL

The amount of cash or other liquid assets that a company must have on hand to meet the current costs of operations until such a time as it is reimbursed by its customers. Sometimes it is used in the narrow sense to mean the difference between Current and Accrued Assets and Current and Accured Liabilities.

SELECTED BIBLIOGRAPHY

Council of Educational Facility Planners, International. "Proposed North Carolina State Plan for the National Energy Conservation Policy Act of 1978." Columbus, OH: Council of Educational Facility Planners, International, 20 October 1979.

Denning, Carsie. NC Controllers Office, Raleigh, NC. Personal Communication, 15 March 1980.

Duke Power Company. Rate Schedules. Charlotte, NC: Duke Power Company, 1 April 1980.

"Energy Plan Questioned by AASA." Education USA 22 (24 March 1980): 231.

Exploring Energy Conservation in Educational Facilities. Proceedings of the Sixth Annual Conference held 22 January 1975 at Knoxville, TN. Knoxville, TN: The School Planning Laboratory of the University of Tennessee, 1975.

"Generalized Recommendations for the Conservation of Energy." Statement issued by the Division of Plant Operations. Raleigh, NC: NC Department of Public Instruction, 1 August 1978.

Neill, Shirley Boes. School Energy Crisis: Problems and Solutions. Sacramento, CA: Education News Service, 1977.

NC Department of Insurance. "Efficient Energy Utilization in New Buildings." North Carolina State Building Code, Volume I - General Construction. Raleigh, NC: NC Department of Insurance, 11 September 1979.

"NC School Plant Energy Conservation Policy." Raleigh, NC: NC Board of Education. Minutes of meeting 2 August 1979.

Shaw, Barbara L. "ECP State Bibliography." Energy Conservation Project Report. 8 (December, 1976): 1-28.

Straley, Joseph. "School System Energy Data Collection and Analysis Project." Piedmont Crescent Energy Project. mimeographed. 1979.

"Transportation." Local Energy Program Manual for Superintendents. Raleigh, NC: NC Department of Public Instruction, December, 1979.

"US Considering More Proposals to Save Energy." The Wall Street Journal, 5 February 1980. p. 2.

US Department of Energy. "Proposed Standby Federal Emergency Energy Conservation Plan." Federal Register 45 (7 February 1980): passim.

US President, Executive Order. "Emergency Building Temperature Restrictions." Federal Register 44 (5 July 1979): 39355.

US Congress, Senate. Energy Policy and Conservation Act. Public Law 94-163. 94th Congress. 1st Session, 1975.

US Congress, House. Energy Conservation and Production Act. Public Law 94-385. 94th Congress. 2nd Session, 1976.

US Congress, House. National Energy Conservation Policy Act. Public Law 95-619. 95th Congress. 1st Session, 1978.

White, Irving L. "Energy Policy Making-Limitations of a Conceptual Model." Bulletin of the Atomic Scientist 27 (October, 1971): 20-26.